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IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF ILLINOIS
EASTERN DIVISION

HU-FRIEDY MFG. CO., INC. an Illinois corporation, Plaintiff, v. DISCUS DENTAL, LLC, a California Limited Liability Company, DISCUS DENTAL IMPRESSIONS, LLC, a California Limited Liability Company, and DISCUS DENTAL CANADA, LLC, a California Limited Liability Company, Defendants.	)	CASE NO. **COMPLAINT**

Plaintiff Hu-Friedy Mfg. Co., Inc. ("Hu-Friedy" or "Plaintiff") for its complaint against defendants DISCUS DENTAL, LLC, DISCUS DENTAL IMPRESSIONS, LLC, and DISCUS DENTAL CANADA, LLC (collectively, "Discus" or "Defendants") seeking damages, injunctive relief and other relief for trade dress infringement, alleges as follows:

PARTIES

1. Hu-Friedy is a Illinois corporation with its principal place of business at 3232 N. Rockwell St., Chicago, Illinois 60618-5935.

2. On information and belief, Discus Dental, LLC is a California Limited Liability Company, having its principal place of business at 8550 Higuera St., Culver City, California 90232.

3. On information and belief, Discus Dental Impressions, LLC is a California Limited Liability Company, having its principal place of business at 8550 Higuera St., Culver City, California 90232.

4. On information and belief, Discus Dental Canada, LLC is a California Limited Liability Company, having its principal place of business at 8550 Higuera St., Culver City, California 90232.

JURISDICTION AND VENUE

5. This Court has jurisdiction over Hu-Freidy's patent infringement claims under 28 U.S.C. §§ 1331 and 1338(a). This Court has jurisdiction over Hu-Friedy's trademark and trade dress infringement claims under 28 U.S.C. §§ 1331 and 1338(a) and 15 U.S.C. § 1121.

6. This Court has personal jurisdiction over Discus because it has transacted and is transacting business in this District, and has used, offered for sale, distributed, and/or sold

products that infringe the trade dress and patents in this judicial district. Defendant Discus makes, uses, sells and/or offers for sale in the United States, including within this judicial district and division, an insert product which infringes Hu-Friedy's United States Patent No. 6,716,028 (the "'028 Patent") and Hu-Friedy's United States Patent No. 7,011,520 (the "'520 Patent"). True and correct copies of the '028 and the '520 Patents are attached as Exhibits A and B, respectively. A copy of Discus's Advertisement for the InSight™ LED Inserts ("Discus Ad") is attached as Exhibit C**.** Discus has substantial and continuous contacts with Illinois and has committed acts of infringement in Illinois, including the Northern District of Illinois, sufficient to confer personal jurisdiction upon Discus.

7. Venue properly lies in this Court under 28 U.S.C. §§ 1391(b) and (c) and 1400(b) because Discus is subject to personal jurisdiction and has committed acts of trade dress infringement and patent infringement in this District.

BACKGROUND

8. On April 6, 2004, the '028 Patent was duly and legally issued for an invention entitled "Ultrasonic Swivel Insert." The '028 Patent is assigned on its face to Hu-Friedy.

9. On March 14, 2006, the '520 Patent was duly and legally issued for an invention entitled "Two Part Ultrasonic Swivel Insert, with One Part Rotatable Relative to the Other." The '520 Patent is assigned on its face to Hu-Friedy.

10. Hu-Friedy has since at least as early as 1997 used a distinctive Baseball Stitch-Style design Mark on or in connection with its products. (hereinafter "Hu-Friedy Baseball Stitch Style Mark")

11. The Baseball Stitch Style design Mark has been used as a trade dress for use on Hu-Friedy's dental insert products, including but not limited to Hu-Friedy's SATIN SWIVEL® and SWIVEL DIRECT FLOW® product lines, as well as other dental insert product lines.

12. Hu-Friedy's trade dress consists of at least the following elements: a Baseball Stitch-Style design for use on its dental insert products with a visible metal end ("Hu-Friedy Trade Dress"). Attached as Exhibit D is a digital picture of an example of the Hu-Friedy Trade Dress and the Hu-Friedy Baseball Stitch Style Mark.

13. The Hu-Friedy Trade Dress is non-functional. It is not essential to the product purpose, and it is not dictated by concern for cost efficiency. This is evidenced by the fact that many other companies in the industry also have different designs on their dental instruments; none of which include the design features of the Hu-Friedy Trade Dress.

14. The Hu-Friedy Baseball Stitch Style Mark and Hu-Friedy Trade Dress is distinctive and identifies Hu-Friedy as the source of its products. Additionally, over the years, the Hu-Friedy Baseball Stitch Style Mark and Hu-Friedy Trade Dress have acquired secondary meaning as the consuming public has come to associate the Baseball Stitch Style Mark and Hu-Friedy Trade Dress with Hu-Friedy.

15. Discus uses, markets, distributes, offers for sale, and/or sells products which infringe the Baseball Stitch Style Mark and Hu-Friedy Trade Dress, including, but not limited to, the InSight™ LED inserts.

COUNT I

Infringement of The Baseball Stitch Style Mark and Hu-Friedy Trade Dress By Defendants' Dental Insert Products (Including But Not Limited To The InSight™ LED insert) Under 15 U.S.C. §1125(a)

16. Hu-Friedy realleges and incorporates herein by reference the allegations in Paragraphs 1 through 15 of its Complaint.

17. Upon information and belief, Discus adopted its trade dress for at least its InSight™ LED inserts with knowledge of the Baseball Stitch Style Mark and Hu-Friedy Trade Dress.

18. Discus misleadingly used, and continues to use, a confusingly similar trade dress to the Baseball Stitch Style Mark and/or Hu-Friedy Trade Dress, which is likely to cause confusion, to cause mistake and to deceive as to Discus's affiliation, connection, association and/or sponsorship with Hu-Friedy.

19. Discus's acts are calculated to deceive, or are likely to deceive the public, which recognizes and associates the Baseball Stitch Style Mark and/or Hu-Friedy Trade Dress with Hu-Friedy. Moreover, Defendants' conduct is likely to cause confusion, to cause mistake or to deceive the public as to the source of Discus's products, or as to a possible affiliation, connection with and/or sponsorship by Hu-Friedy.

20. Discus's conduct has caused Hu-Friedy to suffer and, unless enjoined by the Court, will cause Hu-Friedy to continue to suffer damage to its operation, reputation, and goodwill, and will suffer the loss of sales and profits that Hu-Friedy would have made but for Discus's acts. Discus has been, and will continue to be, unjustly enriched by its unlawful acts.

21. Hu-Friedy has no adequate remedy at law. Defendants' conduct has caused and, if not enjoined, will continue to cause irreparable damage to Hu-Friedy. As a result of Defendants' wrongful conduct, Hu-Friedy is entitled to injunctive relief, Defendants' profits, damages, and attorneys fees and costs.

COUNT II

Federal Unfair Competition

Federal Unfair Competition With Respect To Defendants' Dental Insert Products (Including But Not Limited to the InSight™ LED insert) Under 15 U.S.C. § 1125(a)

22. Hu-Friedy realleges and incorporates by reference the allegations in Paragraphs 1 through 21 of its Complaint.

23. Defendants' InSight™ LED insert product utilizes the Baseball Stitch Style Mark and/or Hu-Friedy Trade Dress in such a way as to unfairly compete in the marketplace by drawing a false association between Defendant's product and Hu-Friedy.

24. Defendants have made false designations of origin and false or misleading descriptions or representations of fact in commercial advertising or promotion which misrepresent the nature, characteristics, or qualities of another person's goods, services or commercial activities in violation of 15 U.S.C. § 1125(a).

25. Defendants have violated, and upon information and belief, intend to continue to willfully, knowingly and intentionally violate 15 U.S.C. § 1125(a)(1)(B) by their unlawful acts in a manner that is likely to cause confusion, mistake or to deceive as to the nature, characteristics or and/or qualities of their goods, services or commercial activities.

26. Defendants' conduct has caused Hu-Friedy to suffer irreparable harm and, unless enjoined by the Court, will cause Hu-Friedy to continue to suffer damage to its operation, reputation, and goodwill, and will suffer the loss of sales and profits that Hu-Friedy would have made but for Defendants' acts. Defendants have been, and will continue to be, unjustly enriched by their unlawful acts.

27. Hu-Friedy has no adequate remedy at law. Defendants' conduct has caused and, if not enjoined, will continue to cause irreparable damage to Hu-Friedy. As a result of Defendants' wrongful conduct, Hu-Friedy is entitled to injunctive relief, Defendants' profits, damages, and attorneys fees and costs.

COUNT III

False Designation Of Origin With Respect To Defendants' Dental Insert Products (Including But Not Limited To The InSight™ LED insert) Under 15 U.S.C. § 1125(a)

28. Hu-Friedy realleges and incorporates herein by reference the allegations in Paragraphs 1 through 27 of its Complaint.

29. Defendants' InSight™ LED insert product utilizes the Baseball Stitch Style Mark and/or Hu-Friedy Trade Dress in such a way as to unfairly compete in the marketplace by drawing a false association between Defendant's product and Hu-Friedy.

30. Defendants have made false designations of origin and false or misleading descriptions or representations of fact in commercial advertising or promotion which misrepresent the nature, characteristics, qualities, sponsorship or association with another person's goods, services or commercial activities in violation of 15 U.S.C. § 1125(a).

31. Defendants have violated, and upon information and belief, intend to continue to willfully, knowingly and intentionally violate 15 U.S.C. § 1125(a) by their unlawful acts in a manner that is likely to cause confusion, mistake or deceive as to the nature, characteristics or and/or qualities of their goods, services or commercial activities.

32. Defendants' conduct has caused Hu-Friedy to suffer irreparable harm and, unless enjoined by the Court, will cause Hu-Friedy to continue to suffer damage to its operation, reputation, and goodwill, and will suffer the loss of sales and profits that Hu-Friedy would have made but for Defendants' acts. Defendants have been, and will continue to be, unjustly enriched by their unlawful acts.

33. Hu-Friedy has no adequate remedy at law. Defendants' conduct has caused and, if not enjoined, will continue to cause irreparable damage to Hu-Friedy. As a result of

Defendants' wrongful conduct, Hu-Friedy is entitled to injunctive relief, Defendants' profits, damages, and attorneys fees and costs.

COUNT IV

Illinois Deceptive Trade Practices Act Under 815 ILCS § 510/1 *et seq*.

34. Hu-Friedy realleges and incorporates herein by reference the allegations in Paragraphs 1 through 33 of its Complaint.

35. The foregoing acts of Defendants constitute a violation of the Illinois Uniform Deceptive Trade Practices Act, 815 Ill. Comp. Stat. 510/1 *et seq*. by creating a likelihood of confusion as to the source of Hu-Friedy's goods and services.

36. Defendants' conduct has caused Hu-Friedy to suffer and, unless enjoined by the Court, will cause Hu-Friedy to continue to suffer damage to its operation, reputation, and goodwill.

37. On information and belief, a reasonable opportunity for discovery will show that Defendants willfully engaged in one or more deceptive trade practices.

38. Hu-Friedy has no adequate remedy at law. Defendants' conduct has caused and, if not enjoined, will continue to cause irreparable damage to Hu-Friedy. As a result of Defendants' wrongful conduct, Hu-Friedy is entitled to injunctive relief, Defendants' profits, damages and attorneys fees and costs.

COUNT V

Illinois Consumer Fraud And Deceptive Business Practices Act

39. Hu-Friedy realleges and incorporates herein by reference the allegations in Paragraphs 1 through 38 of its Complaint.

40. Under the Illinois Uniform Deceptive Trade Practices Act, "[a] person engages in a deceptive trade practice when, in the course of his or her business, vocation, or occupation, the person . . . causes likelihood of confusion or of misunderstanding as to the source, sponsorship, approval, or certification of goods or services." 815 ILCS 510/2(a)(2). The Act further defines "any other conduct which similarly creates a likelihood of confusion or misunderstanding" as a deceptive trade practice. 815 ILCS 510/1(5).

41. As alleged in further detail above, Defendants created a likelihood of confusion and/or affiliation and/or sponsorship with Hu-Friedy based upon its infringing activities.

42. Such misrepresentations will produce confusion and misunderstanding in the public as to the source of these products. The public has an interest in being able to correctly identify the source of the Hu-Friedy products.

43. Should such misrepresentations continue, it will produce an irreparable injury to Hu-Friedy by allowing Discus, as a user and distributor of related and competing products, to unfairly and improperly market their goods through misleading statements.

44. Defendants' conduct has caused Hu-Friedy to suffer and, unless enjoined by the Court, will cause Hu-Friedy to continue to suffer damage to its operation, reputation, and goodwill.

45. On information and belief, a reasonable opportunity for discovery will show that Defendants willfully engaged in one or more deceptive trade practices.

46. Hu-Friedy has no adequate remedy at law. Defendants' conduct has caused and, if not enjoined, will continue to cause irreparable damage to Hu-Friedy. As a result of Defendants' wrongful conduct, Hu-Friedy is entitled to injunctive relief, Defendants' profits, damages and attorneys fees and costs.

COUNT VI

Common Law Unfair Competition

47. Hu-Friedy realleges and incorporates by reference the allegations in Paragraphs 1 through 46 of its Complaint.

48. Defendants' acts and uses constitute unfair competition under common law.

49. Furthermore, Defendants induced and otherwise requested other parties to commit acts and make uses that constitute unfair competition under common law on their behalf.

50. Defendants' acts have caused, and is causing, irreparable harm to Hu-Friedy. Unless this Court enjoins Defendants from continuing its unauthorized acts, Hu-Friedy will continue to suffer irreparable harm. As a result of Defendants' wrongful conduct, Hu-Friedy is entitled to injunctive relief, Defendants' profits, damages, and attorneys fees and costs.

COUNT VII

Patent Infringement Of U.S. Patent No. 6,716,028

51. Plaintiff realleges and incorporates herein by reference the allegations in Paragraphs 1 through 50 of its Complaint.

52. Upon information and belief and a reasonable opportunity for discovery will show that by using, importing, selling, and/or offering to sell their InSight™ LED insert product, Defendants have infringed one or more claims of the '028 Patent directly, contributorily, and/or through inducement. Defendants have engaged in the foregoing conduct with respect to the patented invention in the United States without authority from Hu-Friedy during the term of the '028 Patent.

53. Upon information and belief, Defendants will not stop using, selling, and/or offering for sale the products at issue to avoid infringing the '028 Patent.

54. Upon information and belief, Defendants' infringement has been deliberate, willful and wanton, and with full knowledge of the '028 Patent.

55. Defendants' conduct has caused Plaintiff to suffer and, unless enjoined by the Court, will cause Plaintiff to continue to suffer damage to its operation, reputation, and goodwill.

56. Plaintiff has no adequate remedy at law. Defendants' conduct has caused and, if not enjoined, will continue to cause irreparable damage to Plaintiff. As a result of Defendants' wrongful conduct, Plaintiff is entitled to a temporary restraining order, injunctive relief and damages.

COUNT VIII

Patent Infringement of U.S. Patent No. 7,011,520

57. Plaintiff realleges and incorporates by reference the allegations in Paragraphs 1 through 56 of its Complaint.

58. Upon information and belief and a reasonable opportunity for discovery will show that by using, selling, and/or offering to sell their InSight™ LED and other dental tools incorporating Hu-Friedy's Design features, Defendants have infringed one or more claims of the '520 Patent directly, contributorily, and/or through inducement. Defendants have engaged in the foregoing conduct with respect to the patented invention in the United States without authority from Hu-Friedy and during the term of the '520 patent.

59. Upon information and belief, Defendants will not stop using, selling, and/or offering for sale the methods at issue to avoid infringing the '520 Patent.

60. Upon information and belief, Defendants' infringement has been deliberate, willful and wanton, and with full knowledge of the '520 Patent.

61. Defendants' conduct has caused Plaintiff to suffer and, unless enjoined by the Court, will cause Plaintiff to continue to suffer damage to its operation, reputation, and goodwill.

62. Plaintiff has no adequate remedy at law. Defendants' conduct has caused and, if not enjoined, will continue to cause irreparable damage to Plaintiff. As a result of Defendants' wrongful conduct, Plaintiff is entitled to a temporary restraining order, injunctive relief and damages.

RELIEF REQUESTED

WHEREFORE, Hu-Friedy requests that the Court enter a judgment in Hu-Friedy's favor and against Discus and provide Hu-Friedy the following relief:

A. Order, adjudge, and decree that Discus has infringed the Hu-Friedy Baseball Stitch Style Mark and Hu-Friedy Trade Dress under 15 U.S.C. § 1125(a);

B. Order, adjudge, and decree that Discus willfully and knowingly infringed the Hu-Friedy Baseball Stitch Style Mark and Hu-Friedy Trade Dress;

C. Issue a temporary restraining order and preliminary and permanent injunctive relief prohibiting Discus and its respective parents, subsidiaries, principals, officers, agents, affiliates, servants, attorneys, employees, and all others in privity with it from using any trade dress which is likely to be confused with the Baseball Stitch Style Mark and/or Hu-Friedy Trade Dress;

D. Order Discus to identify and recall from customers and destroy all infringing materials, including but not limited to all packaging and advertising incorporating the infringing trade dress or any other trade dress confusingly similar to the Baseball Stitch Style Mark and/or Hu-Friedy Trade Dress;

E. Award Hu-Friedy damages for trade dress infringement including prejudgment interest and costs against Discus under 15 U.S.C. § 1117;

F. Award Hu-Friedy three times its damages to compensate Hu-Friedy under 15 U.S.C. § 1117;

G. Award Hu-Friedy its reasonable attorneys' fees under 15 U.S.C. § 1117;

H. Order, adjudge, and decree that Defendants have infringed the '028 Patent;

I. Order, adjudge, and decree that Defendants willfully and knowingly infringed the '028 Patent;

J. Order, adjudge, and decree that Defendants' infringement of the '028 Patent is exceptional under 35 U.S.C. § 285;

K. Issue temporary, preliminary and/or permanent injunctive relief prohibiting Defendants and their respective parents, subsidiaries, principals, officers, agents, affiliates, servants, attorneys, employees, and all others in privity with them from infringing the '028 Patent;

L. Order, adjudge, and decree that Defendants have infringed the '520 Patent;

M. Order, adjudge, and decree that Defendants willfully and knowingly infringed the '520 Patent;

N. Order, adjudge, and decree that Defendants' infringement of the '520 Patent is exceptional under 35 U.S.C. § 285;

O. Issue temporary, preliminary and/or permanent injunctive relief prohibiting Defendants and their respective parents, subsidiaries, principals, officers, agents, affiliates, servants, attorneys, employees, and all others in privity with them from infringing the '520 Patent;

P. Award Plaintiff damages for patent infringement including prejudgment interest and costs against Defendants under 35 U.S.C. § 284;

Q. Award Plaintiff three times its damages to compensate Plaintiff under 35 U.S.C. § 284;

R. Award Plaintiff its reasonable attorneys' fees under 35 U.S.C. § 285; and

S. Award such other and further relief as the Court may deem just.

JURY DEMAND

Hu-Friedy demands trial by jury.

Dated: July 25, 2008

Respectfully submitted,

HU-FRIEDY MFG. CO., INC.

____/s/__Kara E.F. Cenar_____
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EXHIBIT A

US006716028B2

(12) **United States Patent**
Rahman et al.

(10) **Patent No.: US 6,716,028 B2**
(45) **Date of Patent: Apr. 6, 2004**

(54) **ULTRASONIC SWIVEL INSERT**

(75) Inventors: **Anisur Mithu Rahman**, Gurnee, IL (US); **Shu Chen**, Buffalo Grove, IL (US); **Patricia H. Parker**, Midlothian, IL (US)

(73) Assignee: **Hu-Friedy Mfg. Co., Inc.**, Chicago, IL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 88 days.

(21) Appl. No.: **09/917,101**

(22) Filed: **Jul. 27, 2001**

(65) **Prior Publication Data**

US 2002/0040198 A1 Apr. 4, 2002

Related U.S. Application Data

(60) Provisional application No. 60/223,447, filed on Aug. 4, 2000, and provisional application No. 60/270,687, filed on Feb. 22, 2001.

(51) **Int. Cl.**[7] **A61C 3/03**
(52) **U.S. Cl.** **433/119**; 433/86
(58) **Field of Search** 433/119, 118, 433/86, 81, 102

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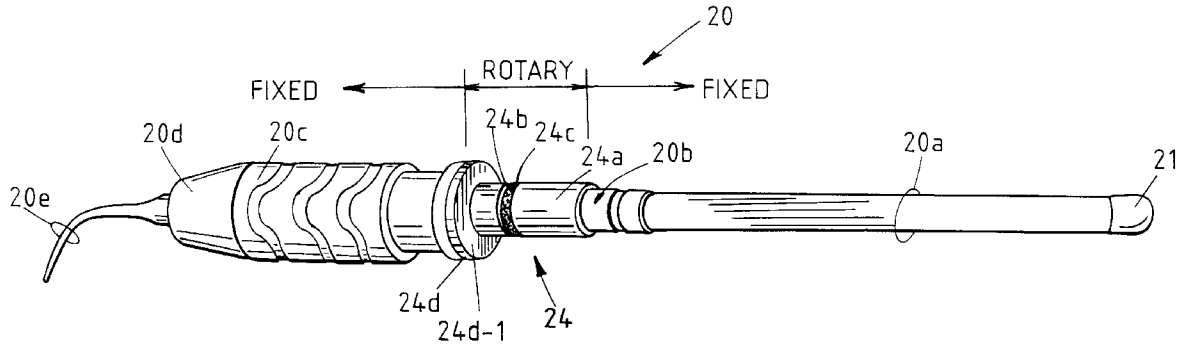
Primary Examiner—Kevin Shaver
Assistant Examiner—Melba Bumgarner
(74) *Attorney, Agent, or Firm*—Welsh & Katz, Ltd.

(57) **ABSTRACT**

An ultrasonic insert carries a rotary bearing adjacent to the transducer. The bearing slidably engages an ultrasonic handpiece. When seated in the handpiece, the insert is substantially decoupled, on a rotary axis, from the handpiece. A rotary force need only be applied to the insert to rotate it in the handpiece. Alternately, an adaptor can be inserted into the handpiece. The adaptor slidably receives a conventional ultrasonic insert. The conventional insert can be easily rotated with a force applied only thereto, relative to the handpiece.

16 Claims, 15 Drawing Sheets



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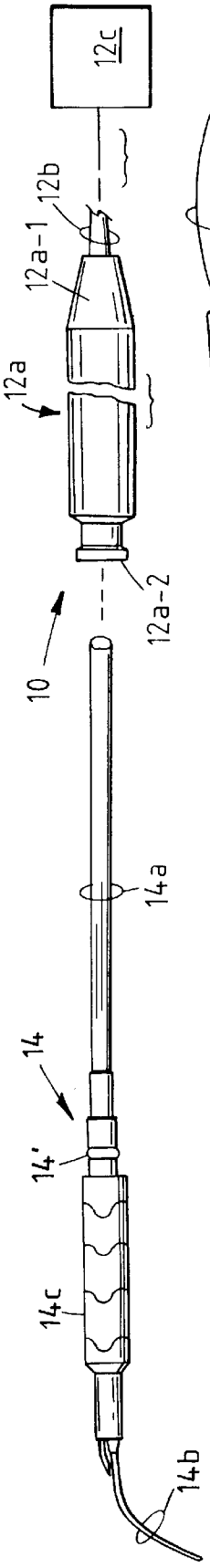


FIG. 1A PRIOR ART

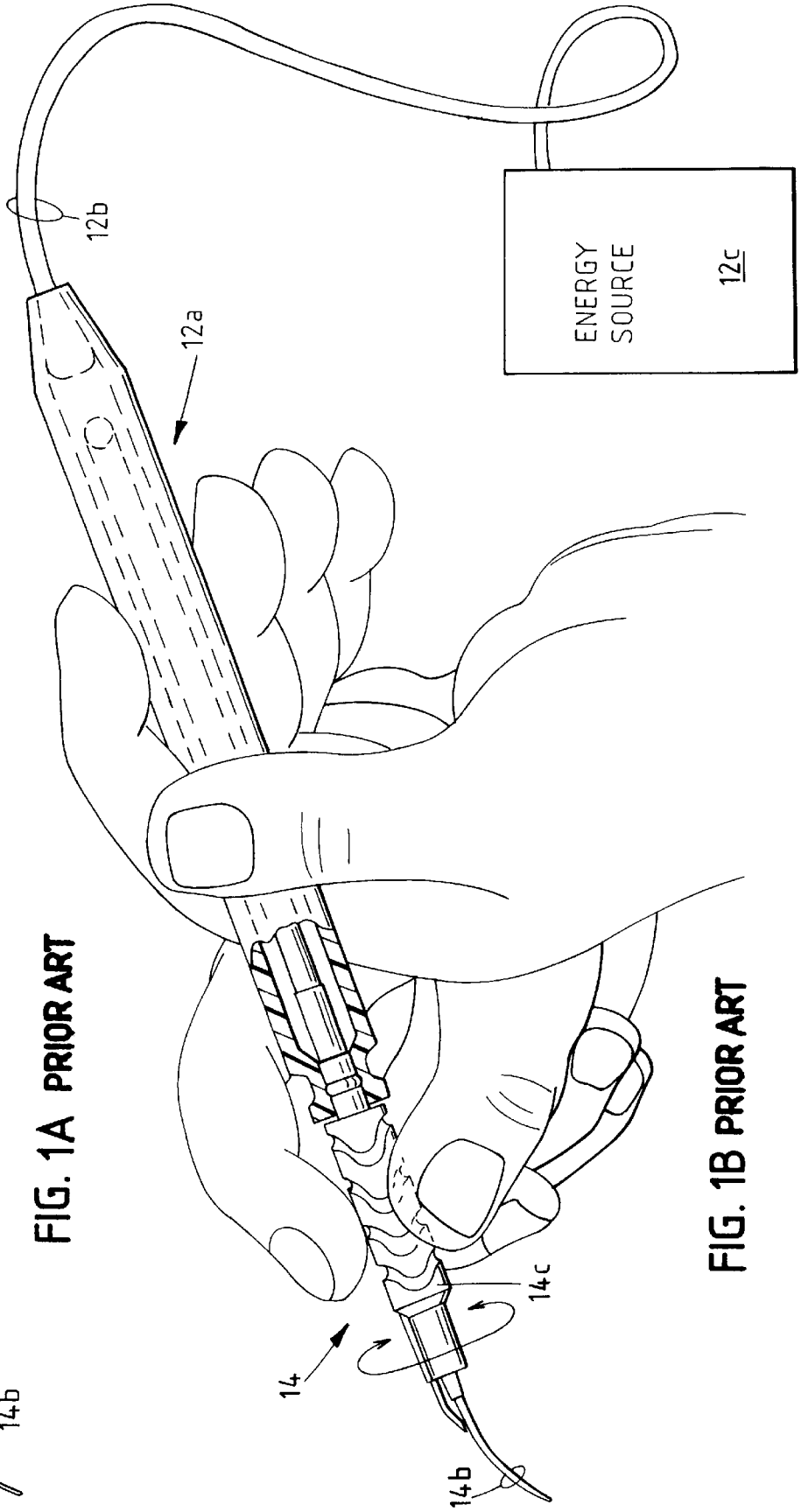


FIG. 1B PRIOR ART

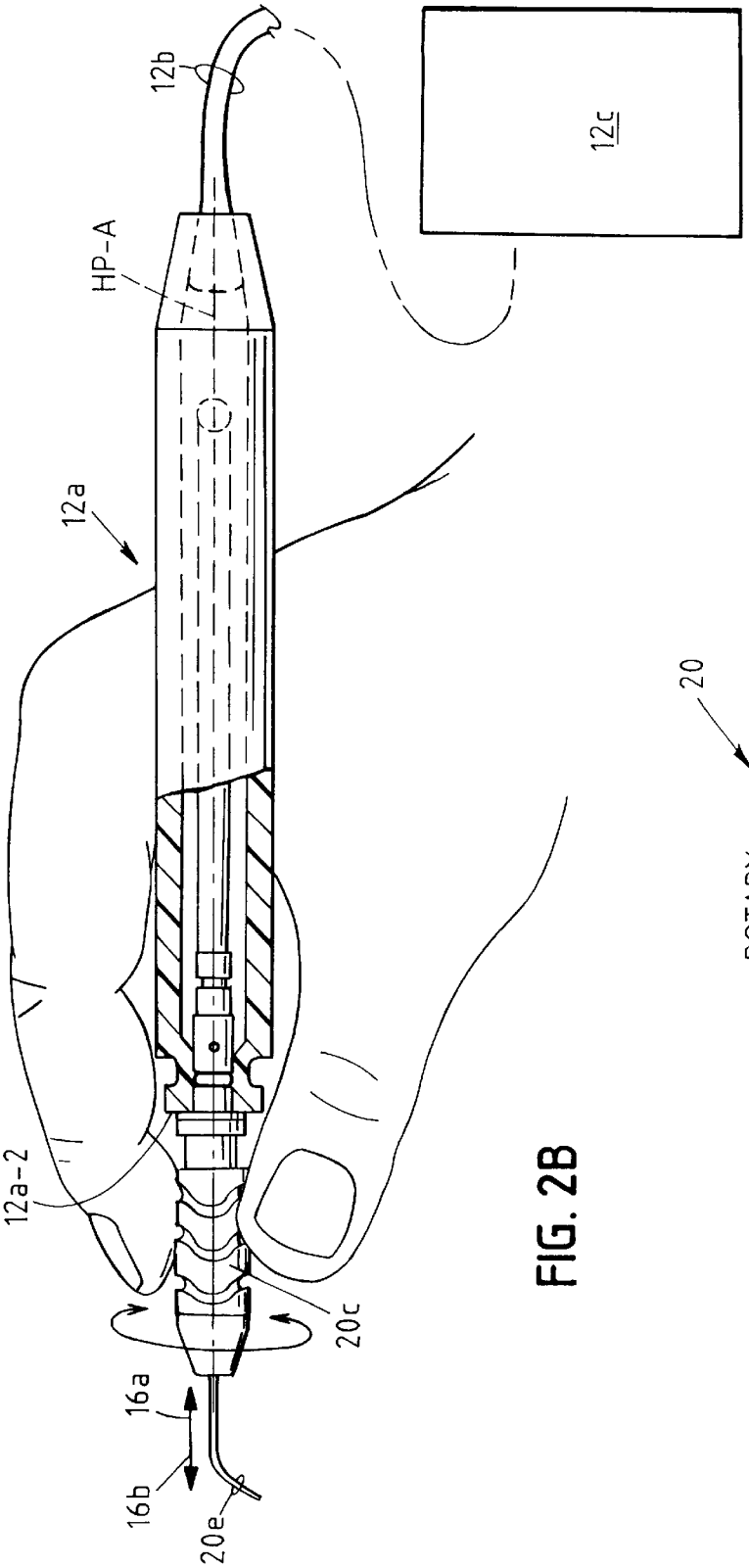

12b
12c
HP-A
12a
12a-2
20c
16a
16b
20e

FIG. 2B

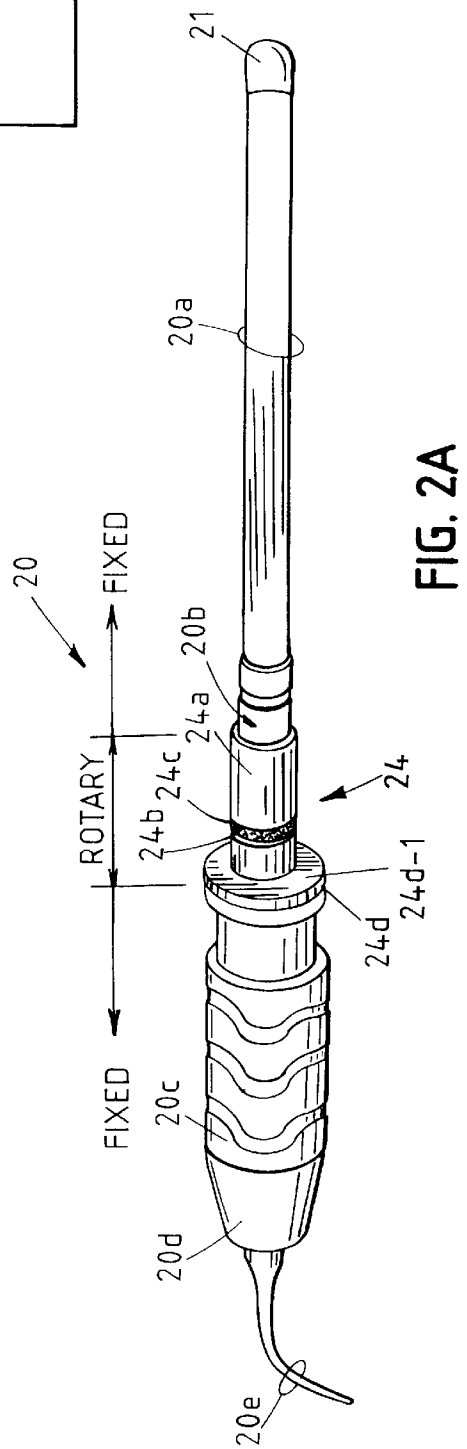

21
20a
20
FIXED
20b
24a
ROTARY
24c
24b
24
24d-1
24d
FIXED
20c
20d
20e

FIG. 2A

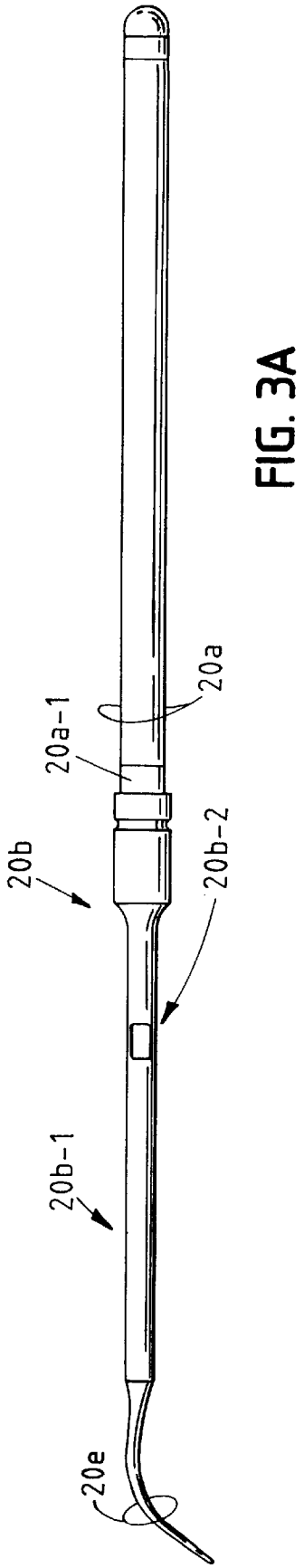


FIG. 3A

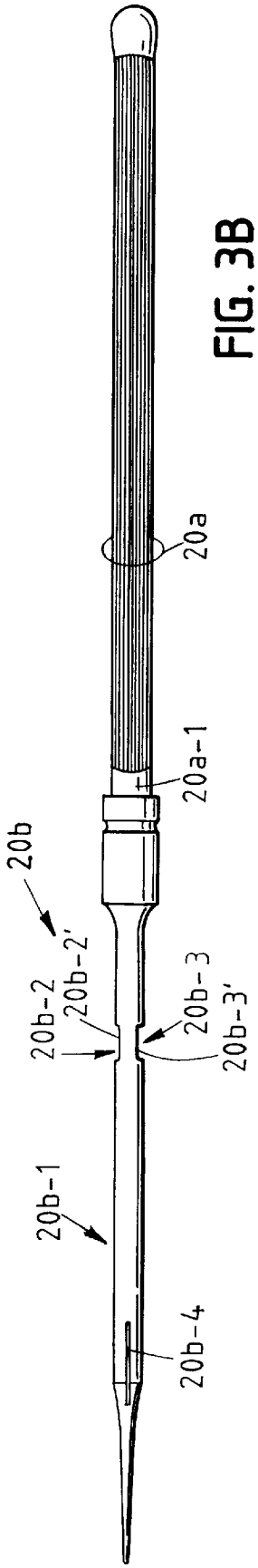


FIG. 3B

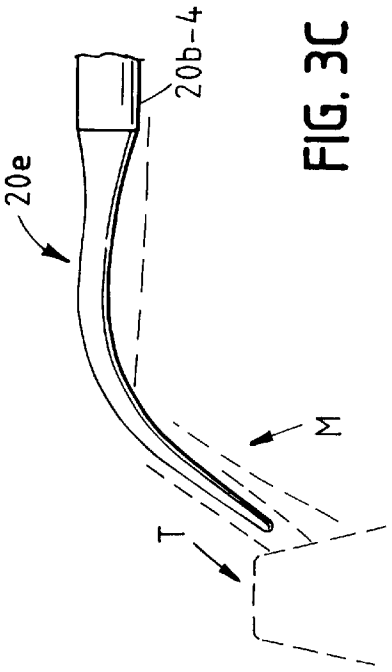


FIG. 3C

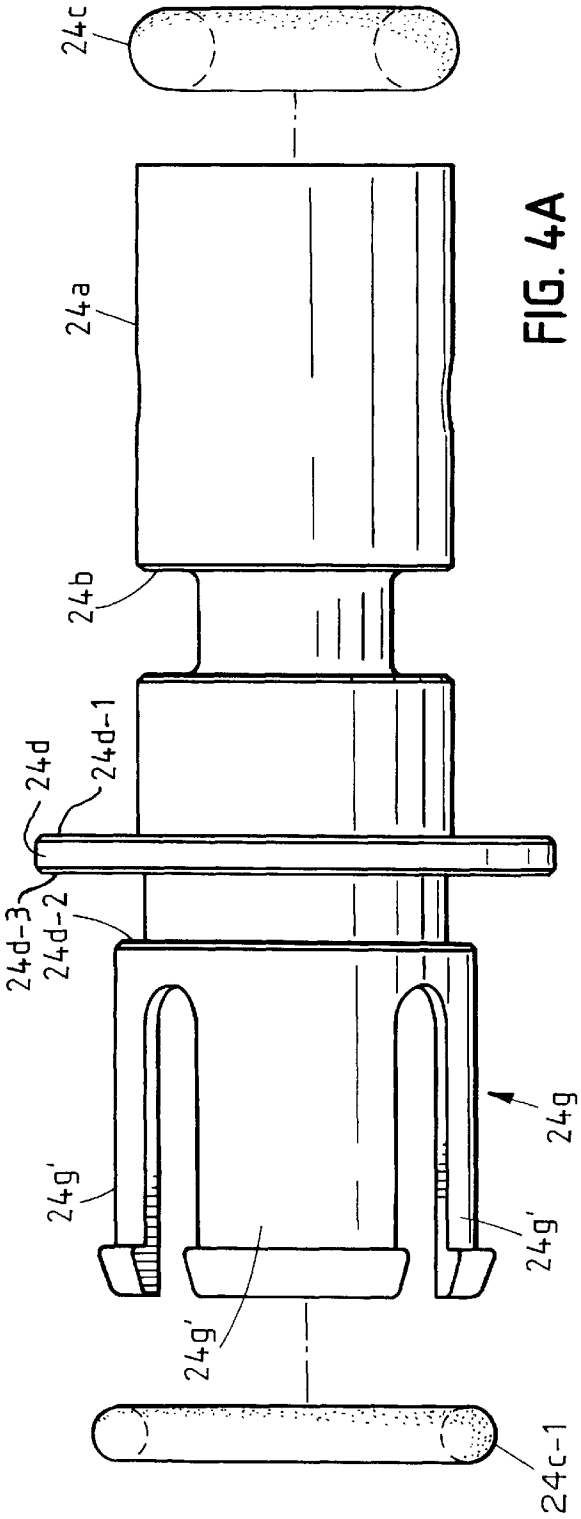

24c
24a
24b
24d
24d-1
24d-3
24d-2
24g
24g'
24g'
24g'
24c-1

FIG. 4A

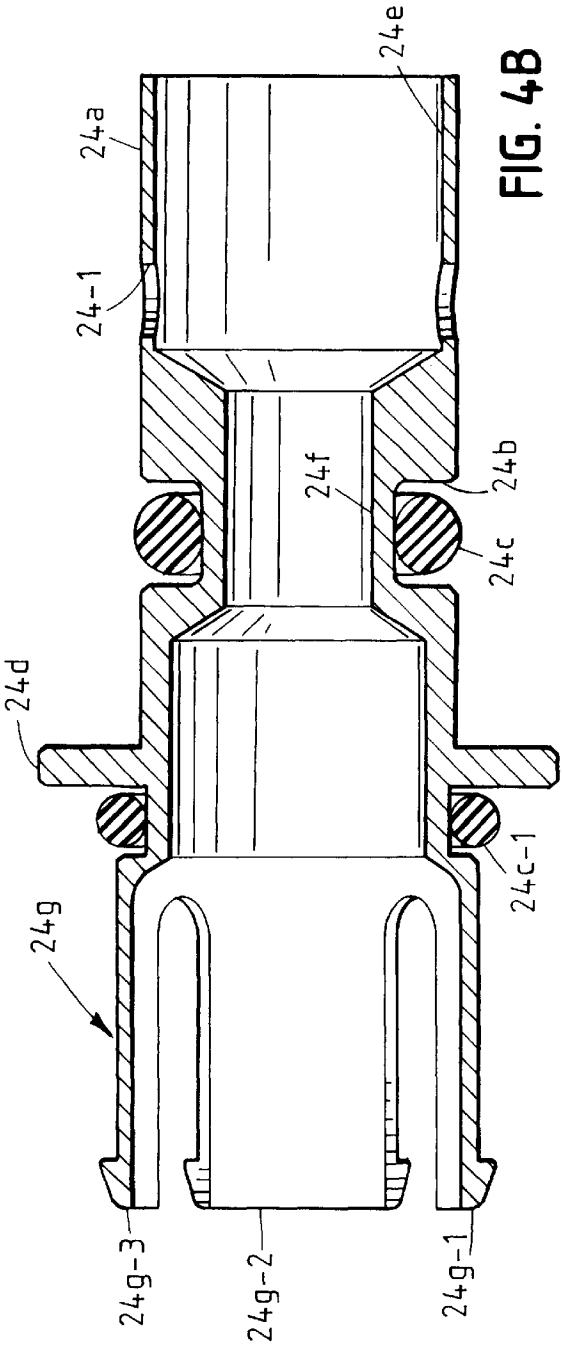

24e
24a
24-1
24f
24b
24c
24d
24c-1
24g
24g-3
24g-2
24g-1

FIG. 4B

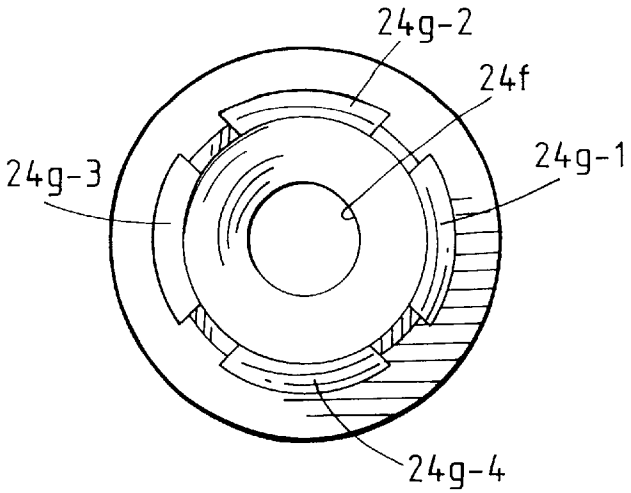


FIG. 4D

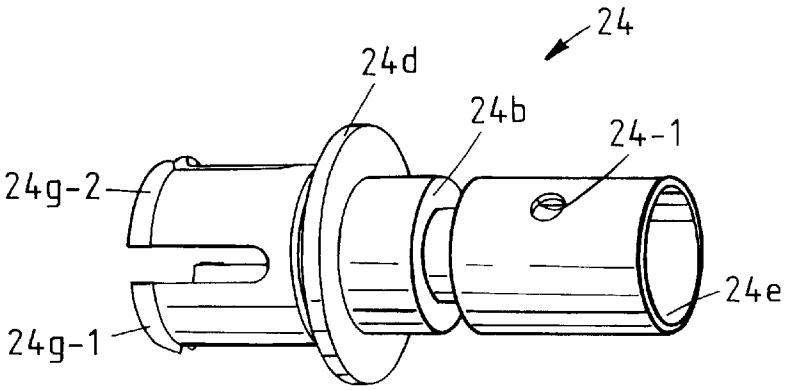


FIG. 4C

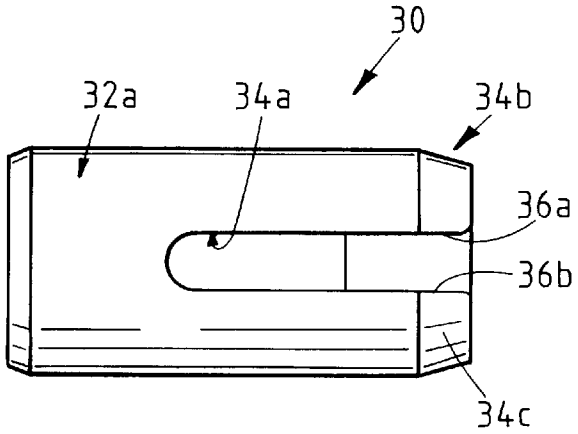


FIG. 5A

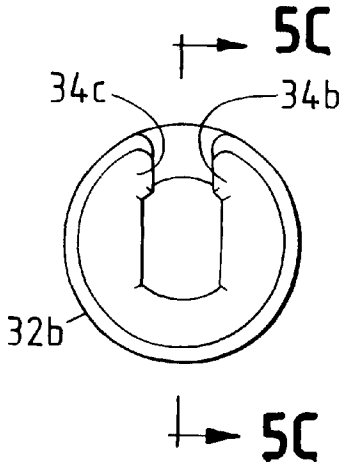


FIG. 5B

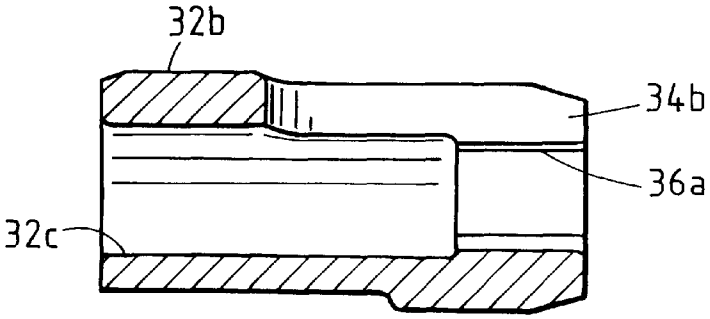


FIG. 5C

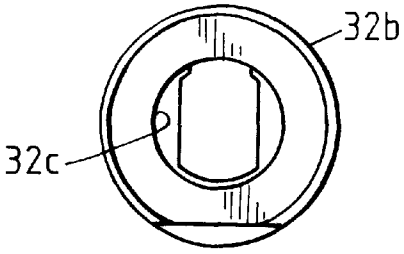


FIG. 5D

FIG. 6A

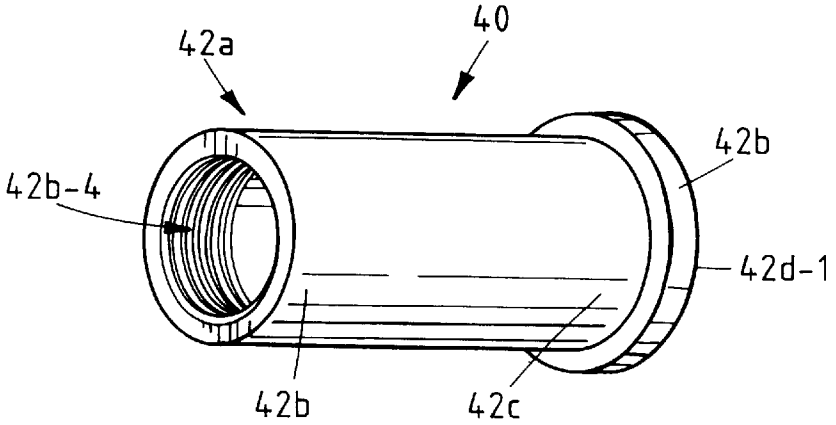


FIG. 6B

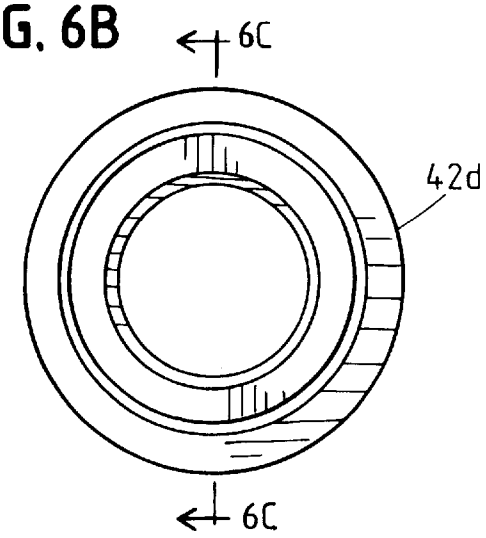
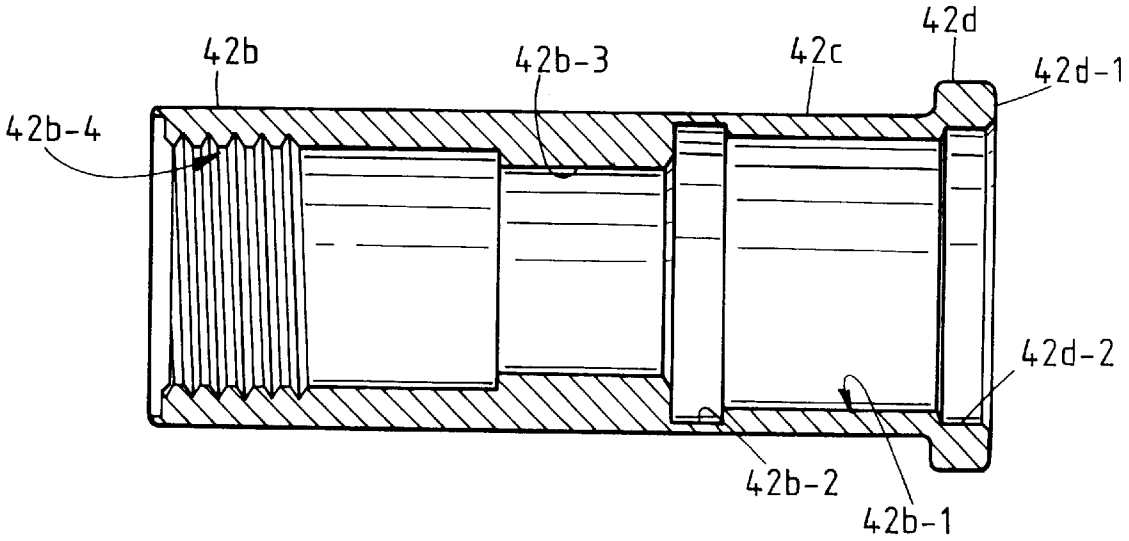


FIG. 6C



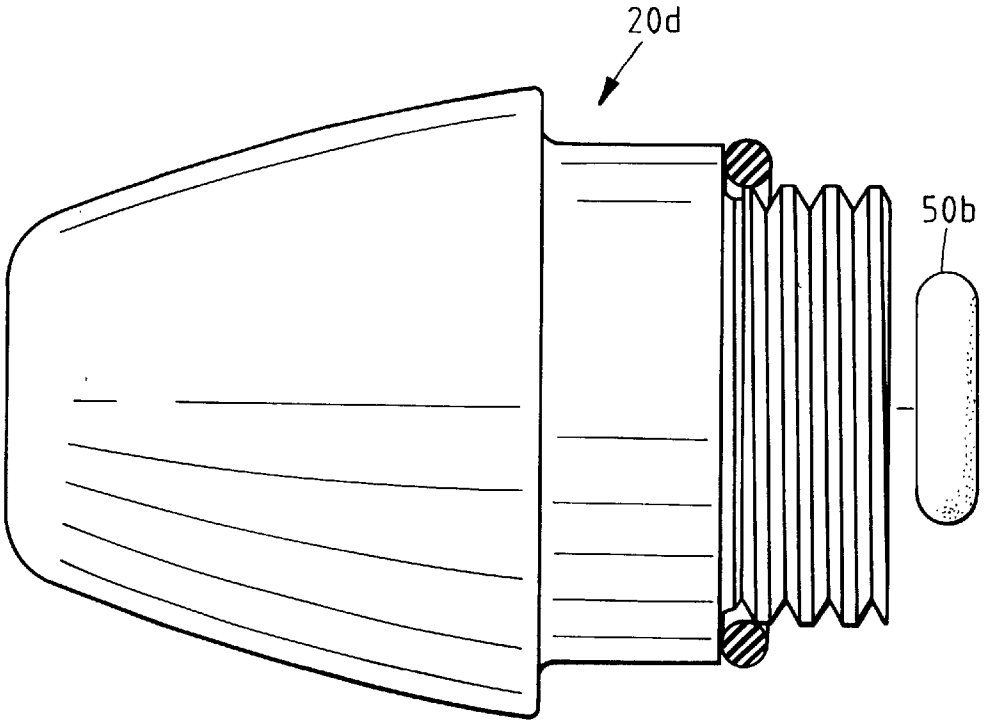


FIG. 7A

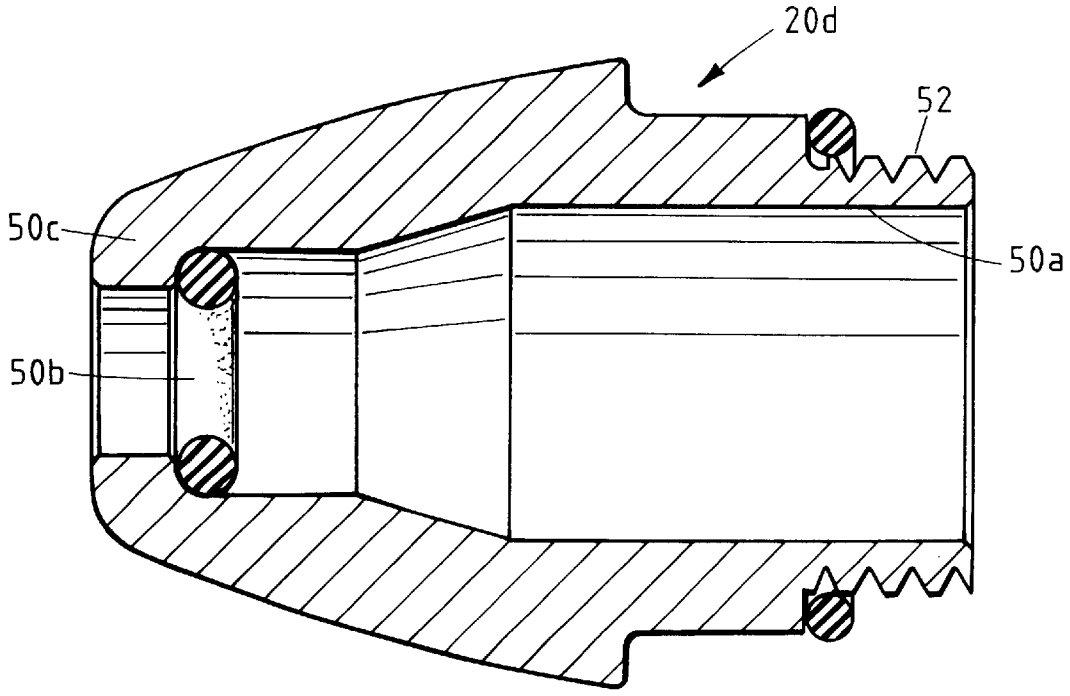


FIG. 7B

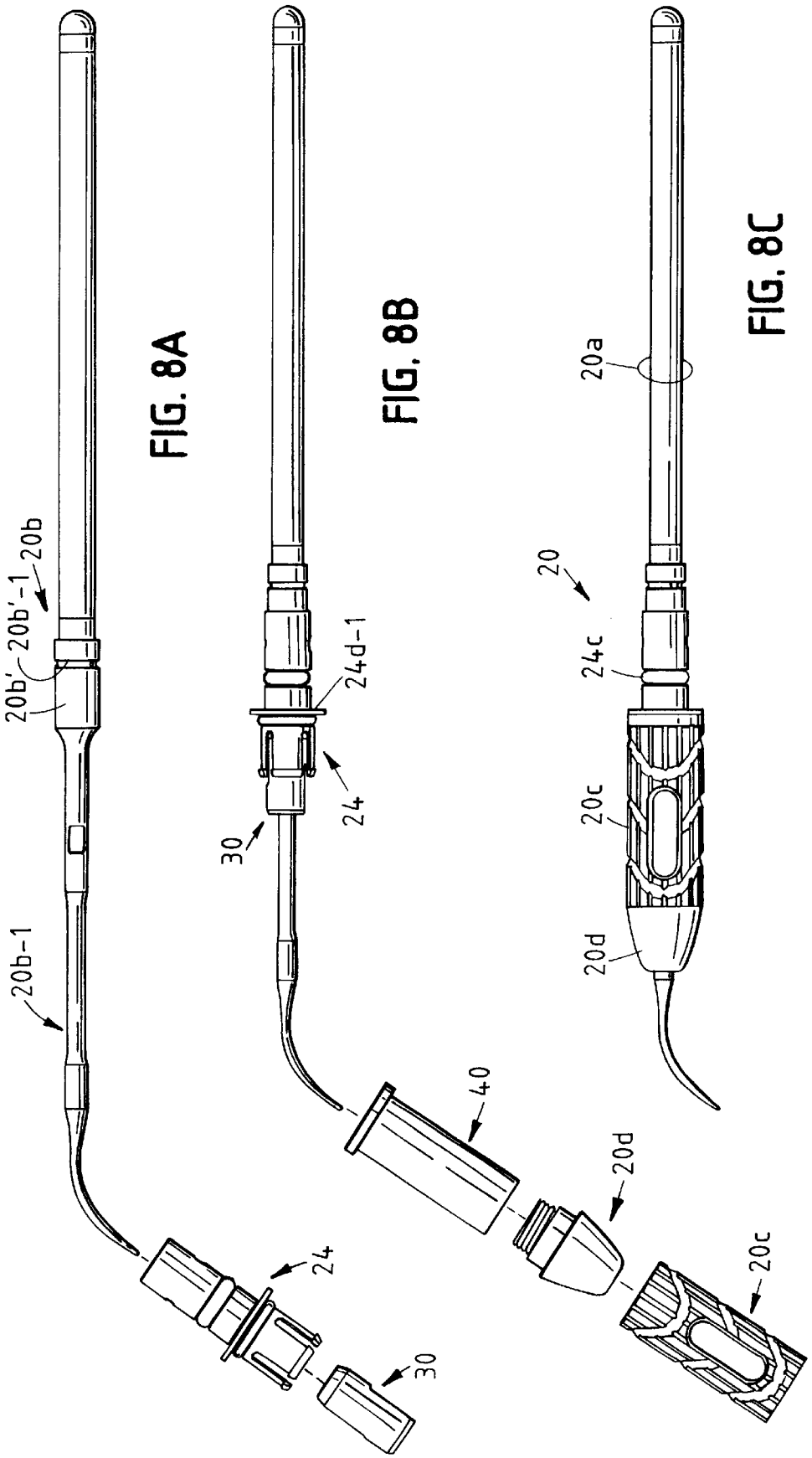


FIG. 8A

FIG. 8B

FIG. 8C

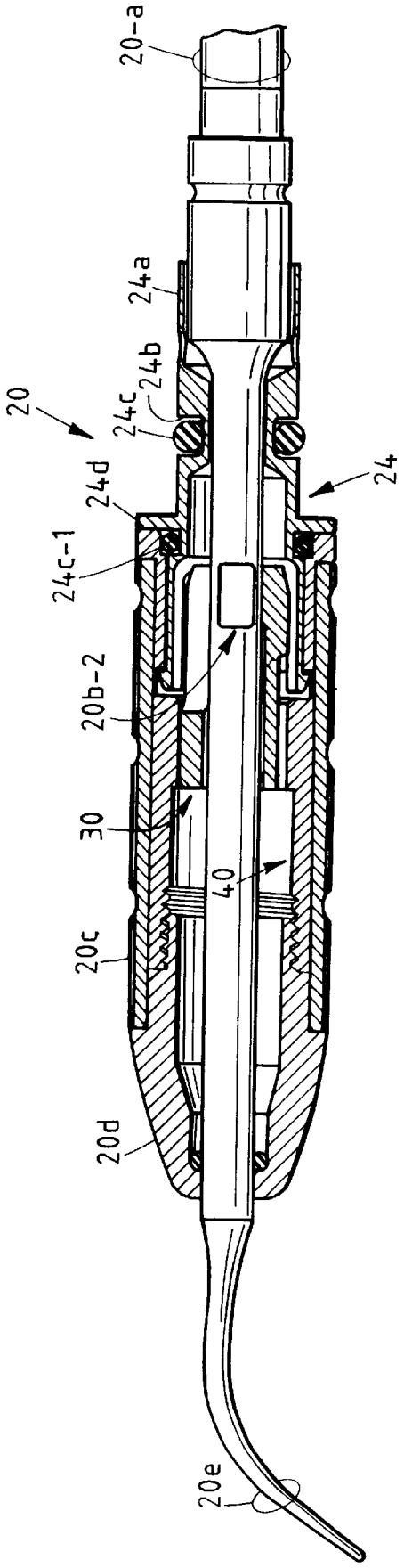


FIG. 9A

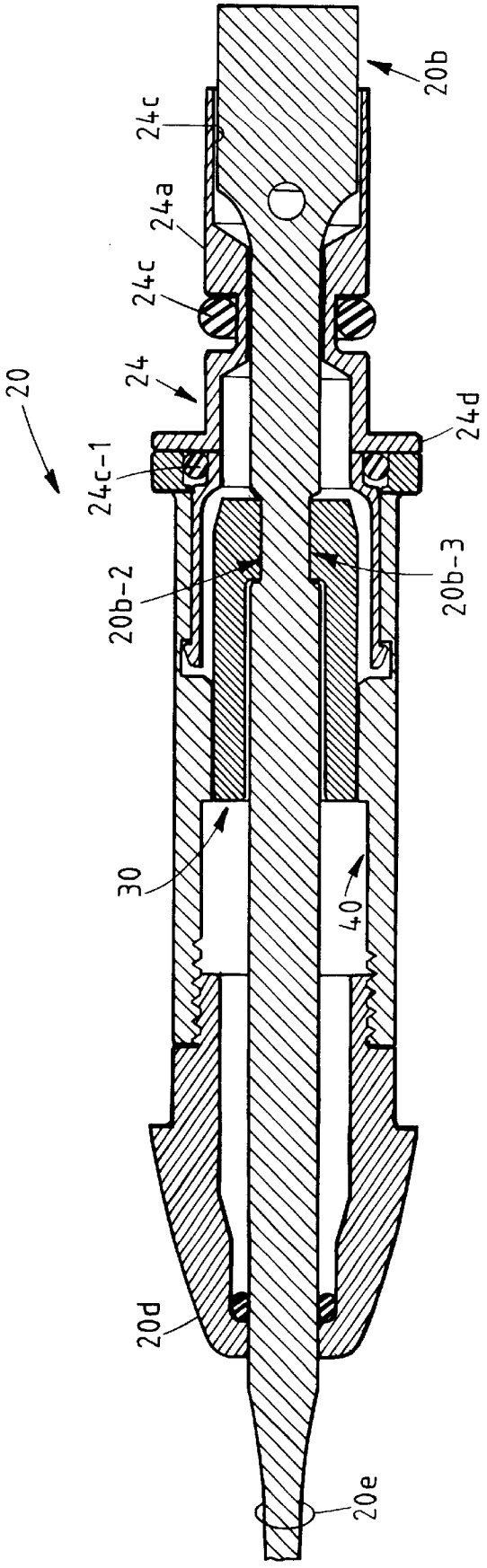


FIG. 9B

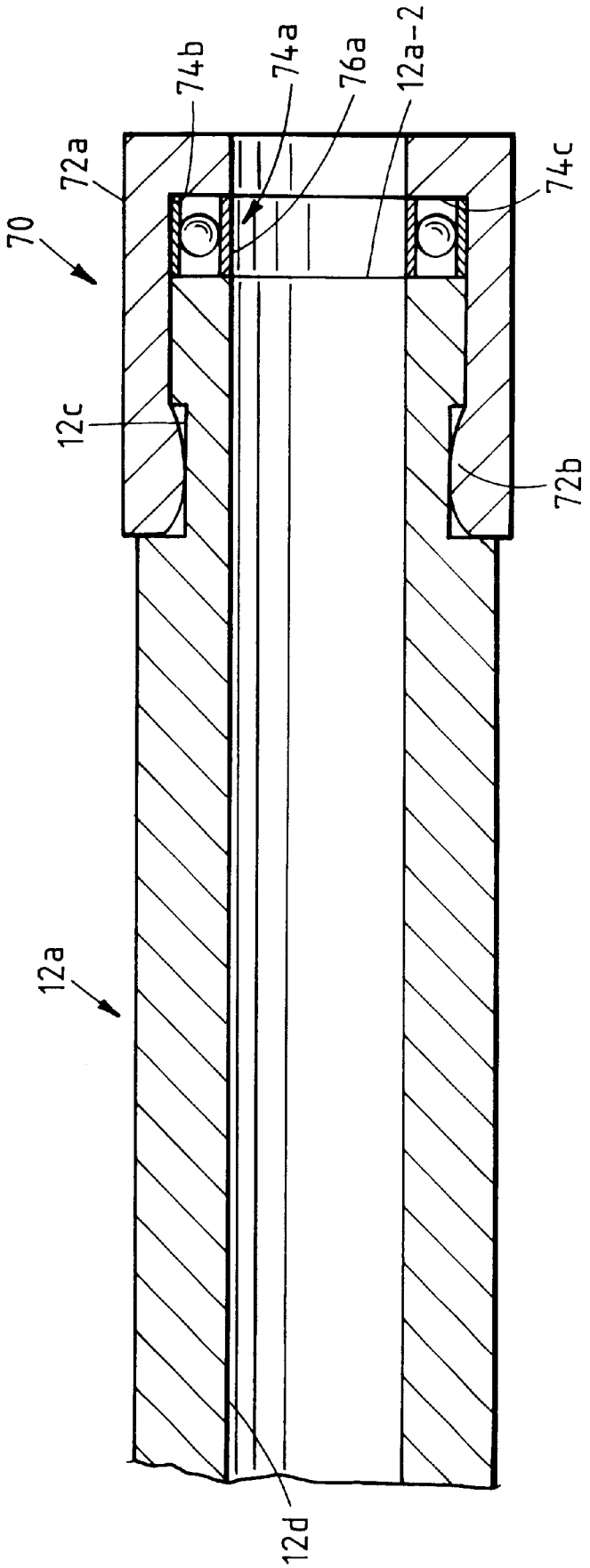


FIG. 10A

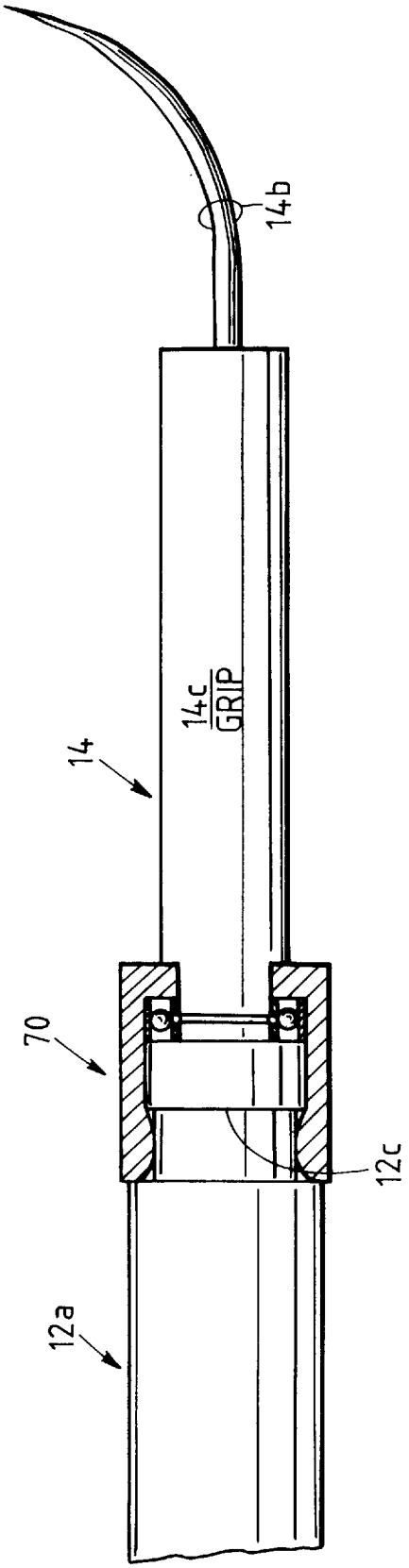


FIG. 10B

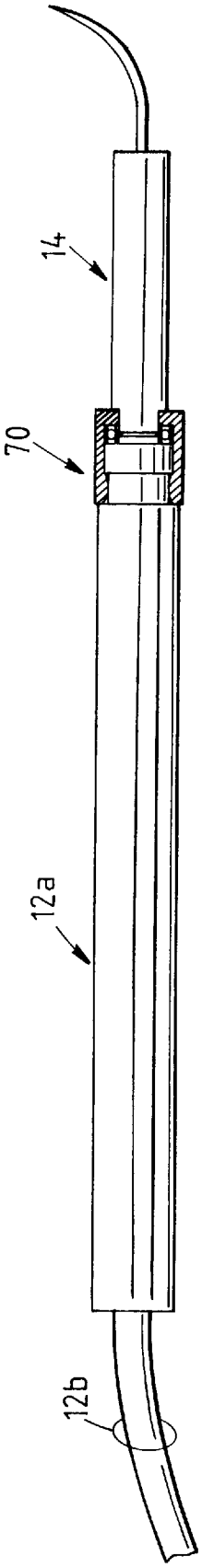


FIG. 10C

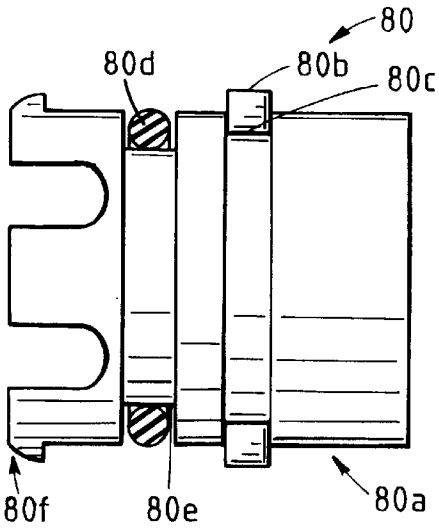


FIG. 11A

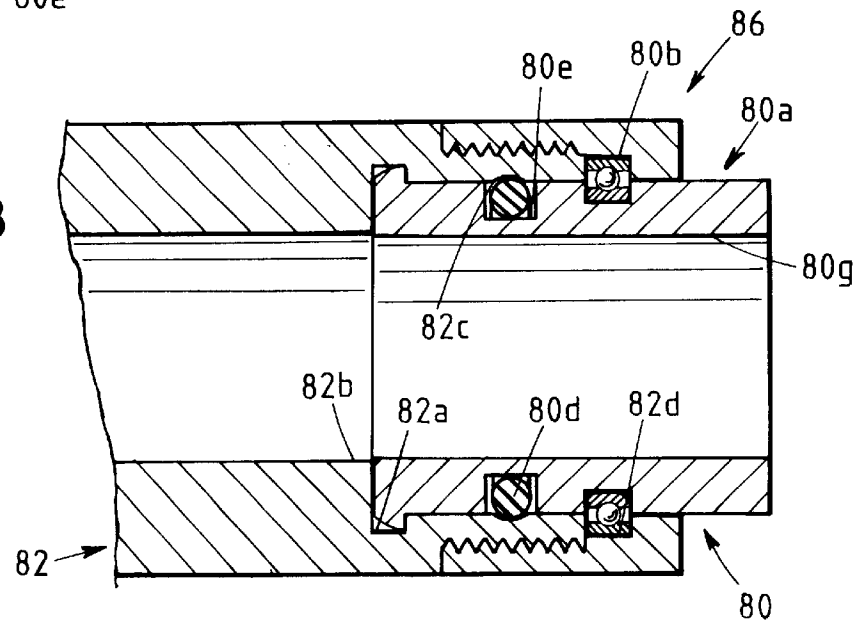


FIG. 11B

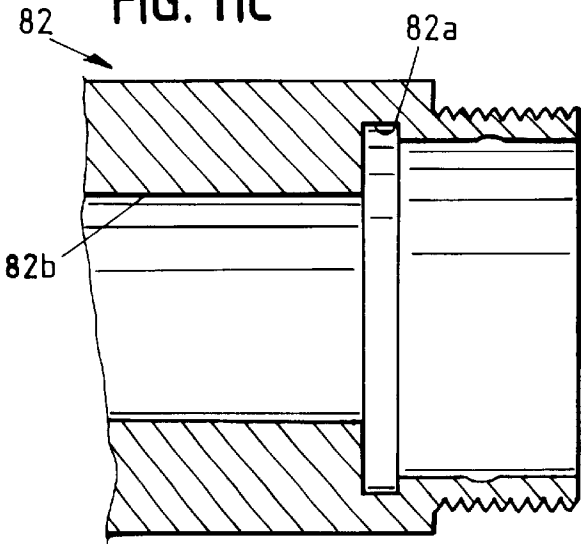


FIG. 11C

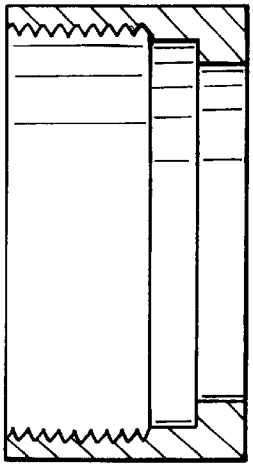


FIG. 11D

FIG. 12A

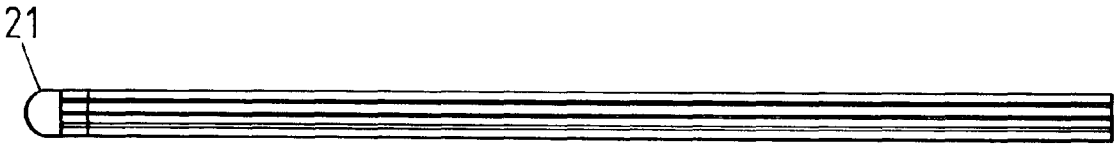


FIG. 12B

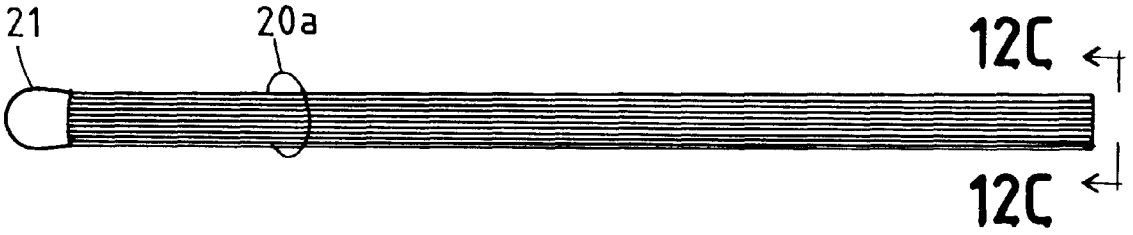
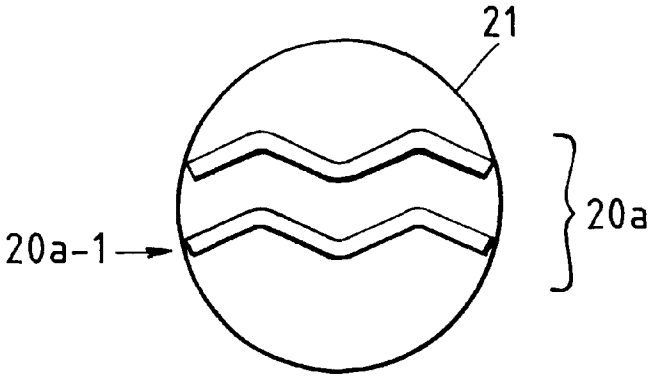


FIG. 12C



ULTRASONIC SWIVEL INSERT

This is a Utility Application claiming the benefit of the earlier filing date of Provisional Application Ser. No. 60/223,447, filed Aug. 4, 2000 and Ser. No. 60/270,687, filed Feb. 22, 2001.

FIELD OF THE INVENTION

The invention pertains to ultrasonic inserts of a type used in medical/dental treatments. More particularly, the invention pertains to such inserts with enhanced operating efficiency and user comfort.

BACKGROUND OF THE INVENTION

Ultrasonic scalers are used in dental offices for de-plaqueing teeth. Unlike manual scalers, these instruments are powered i.e., the tip of the instrument vibrates at an ultrasonic frequency allowing quick and easy debridement. The operator has less hand fatigue as most of the energy for removing the plaque comes from the generator that powers the instrument. The dental practitioner need only lightly touch the tip of the instrument at an angle to the tooth surface to dislodge the plaque.

Known ultrasonic scalers, such as scaler **10** illustrated in FIG. **1**A, have a handpiece **12***a* coupled at one end **12***a*-**1** to a cable **12***b* which includes a hose, to provide a fluid, and conductors to provide electrical energy. The other end of the cable **12***b* terminates at an electrical generator and fluid source **12***c*. One type of fluid is water.

The other end of the handpiece **12***a*-**2** is hollow and is intended to receive a replaceable insert **14** with a transducer **14***a* (magnetostrictive or piezoelectric) carried on the insert. The transducer **14***a* extends from a proximal end of the insert **14** into the hollow body **12***a*-**2**. An ultrasonically vibrated tip **14***b* extends from a distal end of the insert. One such insert has been disclosed and claimed in U.S. Pat. No. 5,775,901, entitled "Insert For Ultrasonic Scaler", incorporated herein by reference.

Known magnetostrictive ultrasonic inserts function by exciting a stack of thin nickel plates at a frequency equal to the stack's natural frequency. The excitation is induced through an electrical generator in unit **12***c*, which supplies a current to a coil embedded in the handpiece. When the insert **14** is placed in the handpiece **12***a* and the frequency generator **12***c* is powered on, the operator tunes the generator (manual tuning) until it reaches the resonance frequency i.e., attains the natural frequency of the insert. Alternately, autotune units automatically lock on the insert resonance frequency once powered on. At this time, the stack starts vibrating. This vibration of the stack is amplified and transmitted to the tip **12***b* by means of a connecting body or concentrator. The connecting body is made from material that provides good sound transmission efficiency.

While the insert **14** is operational, fluid is pumped through the cable-generator system **12***b, c* and through the handpiece **12***a* to the tip **14***b* of the insert **14**. The vibrating tip **14***b* breaks the fluid stream into a spray. The spray not only keeps the tip cool, but also keeps the surface of the tooth cool and provides protection against tissue damage.

The fluid path through the handpiece **12***a* needs to be sealed such that no leakage occurs until the fluid stream exits from the insert at the very tip through a fluid delivery channel. Typically, ultrasonic inserts do not have any moving parts other than the minuscule displacement of the nickel stack, the connecting body or the tip.

Known magnetostrictive dental scaling ultrasonic inserts used in the U.S.A. are designed to vibrate at 25 kHz or 30 kHz frequencies. Another system, popular in Europe, uses a piezoelectric transducer.

In using an ultrasonic scaler during a cleaning, the dental practitioner will need to repeatedly re-orient the location of the insert tip **14***b* with respect to tooth surface depending on which tooth of the mouth is being cleaned. In making this angular adjustment, as illustrated in FIG. **1**B, the practitioner will typically take the insert out of the patient's mouth, rotate the insert **14**, and tip **14***b*, inside the handpiece **12***a* locating tip **14***b* at a desired angular position. Both hands are used for this rotation as the frictional forces that produce a tight fit of the insert **14** in handpiece **12***a* must be overcome. During a typical treatment, the process of reorienting the tip must be carried out numerous times. This is not only time consuming but also interrupts the ease and smooth flow of work.

In areas of the mouth where the practitioner chooses not to rotate the insert **14**, the practitioner's wrist must be twisted sufficiently to achieve the same function. This twisting action is opposed by the resistance of the cable **12***b*, the fluid supply hose and power conductors, which is attached to the handpiece **12***a*.

There continues to be a need for ultrasonic scalers which are more comfortable and less fatiguing to use than known instruments. Preferably, any improvements will be downwardly compatible with the numerous generators and handpieces that are already present in dental offices.

SUMMARY OF THE INVENTION

A rotatable ultrasonic insert has a body section which carries a bearing for rotatably engaging an ultrasonic handpiece. The body is rotatable, about an axial centerline.

Rotation can be effected by applying a force only to the insert. In response, the insert rotates but the handpiece does not. Hence, single handed, two finger rotation is possible.

Preferably, a swivel feature is located at the gripping region of the insert, i.e., close to the treatment tip, where the practitioner would typically position his or her fingers. The swivel allows the insert to rotate 360 degrees without any limitation. This enables the practitioner to position the insert, and the tip, at any angular orientation without having to take the insert out of the patient's mouth. The swivel also allows rotation of the gripping region and tip without having to rotate the handpiece and/or the supply cord. This removes the resistance from the operator's hand and reduces hand fatigue.

Additionally, a large diameter grip or handle, not only reduces finger fatigue but also transmits a larger torque to the swivel feature for the same amount of force.

An elastomeric handle, carried by the body, comfortably interfaces with a user's fingers. The user can rotate the elastomeric handle and the insert with two fingers relative to the handpiece. Hence, during treatment there will be no need to rotate the handpiece.

The elastomeric material allows for a positive grip since it deforms under finger pressure and becomes locally non-cylindrical in shape. The preferred material is silicone. Silicone is not only repeatedly sterilizable under most sterilization processes found in dental offices but also provides good traction with respect to the type of gloves which are commonly used in dental offices.

The elastomeric handle engages the body only at a region of minimal ultrasonically induced, vibration. The limited

connectivity between the body and the elastomeric handle minimizes build up of heat between the body and that handle. It also avoids damping ultrasonic vibrations transmitted along the body.

A method of assembly includes:

providing a body which carries an ultrasonic transducer, at one end, and, a displaced treatment applying tip at the other end;

sliding a rotary handle past the treatment applying tip toward the bearing;

connecting the handle to the body at a region of minimal ultrasonic vibration.

In another aspect of the invention, an adaptor has an external periphery which can be slidably and releasibly inserted into the opening in the handpiece. A standard ultrasonic insert is inserted through the adaptor into the handpiece. The insert can then be rotated relative to the handpiece with a rotational force applied only thereto. Alternatively, the adaptor can be snap fitted onto an exterior periphery of a handpiece.

Numerous other advantages and features of the present invention will become readily apparent from the following detailed description of the invention and the embodiments thereof, from the claims and from the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1**A illustrates a prior art ultrasonic scaler having an insert and handpiece;

FIG. **1**B illustrates one aspect of usage of the prior art insert/handpiece combination of FIG. **1**A;

FIG. **2**A illustrates an insert in accordance with the present invention;

FIG. **2**B illustrates the insert of FIG. **2**A in a handpiece as in FIG. **1**A and aspects of usage thereof;

FIGS. **3**A, B and C are various views of an ultrasonic insert body in accordance with the present invention;

FIGS. **4**A, B, C and D are various views of a snap-fit rotary bearing usable with the body of FIG. **3**A;

FIGS. **5**A, B, C and D are various views of a torque lock in accordance with the present invention;

FIGS. **6**A, B and C are various views of a swivel housing in accordance with the present invention;

FIGS. **7**A, B are various views of a cone usable in an insert in accordance with the present invention;

FIGS. **8**A, B and C illustrate steps in assembling an insert in accordance with the present invention;

FIG. **9**A is a side sectional view of an insert in accordance with the invention illustrating the relationship of various elements assembled in the steps of FIGS. **8**A, B and C;

FIG. **9**B is an enlarged sectional view illustrating aspects of a section of FIG. **9**A;

FIG. **10**A is a side sectional view of a handpiece carrying a snap-on adaptor in accordance with the present invention;

FIG. **10**B is an enlarged partial side view of the handpiece and adaptor of FIG. **10**A with a conventional ultrasonic insert positioned therein;

FIG. **10**C is an over-all view of an insert as in FIG. **1** combined with an adaptor as in FIG. **10**A;

FIG. **11**A is an enlarged side view of an alternate embodiment of an insert in accordance with the present invention;

FIG. **11**B is an enlarged partial side sectional view of the insert of FIG. **11**A inserted into a handpiece of an ultrasonic scaling unit, generally of a type illustrated in FIG. **1**;

FIG. **11**C is a side view of a portion of the handpiece of FIG. **11**B;

FIG. **11**D is a side view of a collar threadable onto the handpiece of FIG. **11**B;

FIGS. **12**A, B are top and side views of a preferred form of an ultrasonic transducer; and

FIG. **12**C is an end view of the transducer of FIG. **12**B.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

While this invention is susceptible of embodiment in many different forms, there are shown in the drawing and will be described herein in detail specific embodiments thereof with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the specific embodiments illustrated.

FIG. **2**A illustrates an insert **20** in accordance with the present invention. The insert **20** includes a transducer **20***a* which is illustrated as a magnetostrictive transducer. Alternately, it could be a piezoelectric ultrasonic transducer without departing from the spirit and scope of the present invention.

The transducer is rigidly coupled to an elongated body **20***b* which is covered in part by a cylindrical, elongated deformable elastomeric grip **20***c*. The grip **20***c* terminates in a cone **20***d* which is positioned between the grip **20***c* and operative treatment applying tip **20***e*.

The insert **20** operates in accordance with the principals of known ultrasonic dental instruments as discussed above relative to FIG. **1**A. However, insert **20** also carries a rotary bearing **24** which exhibits a hollow cylindrical stem section **24***a* which defines a cylindrical region **24***b* which receives a sealing O-ring **24***c*. The hollow member **24***a* terminates at a disc **24***d* of larger diameter. A planar surface **24***d*-**1** of disk **24** is adjacent to stem **24***a*.

As discussed subsequently, when installed on the elongated body **20***b*, the rotary bearing member **24** is rotatable relative to the body **20***b*, gripping member **20***c* and tip **20***e*. Hence, if the member **24** is fixed, the body **20***b*, gripping member **20***c* and tip **20***e* are readily rotatable therein.

FIG. **2**B illustrates the standard ultrasonic handpiece **12***a*, cable **12***b* and generator **12***c*, discussed above, of a type found in dental offices. The insert **20** is slidably receivable, in a direction **16***a*, in the hollow end **12***a*-**2** of the handpiece **12***a*.

The cylindrical stem **24***a* of the rotary bearing **24** slides into the hollow handpiece **12***a*. The O-ring **24***c* slidably engages the interior periphery of the handpiece **12***a* providing a fluid seal and reliably engaging the insert **20** with the handpiece **12***a*.

When installed in the handpiece **12***a*, as illustrated in FIG. **2**B, insert **20** can be rotated relative to handpiece **12***a* with rotary forces applied to the deformable gripping member **20***c* for purposes of orienting the tip **20***e* relative to a tooth being deplaqued. As illustrated in FIG. **2**B, the practitioner need not restrain the handpiece **12***a* while rotating the insert **20**. Additionally, insert **20** is relatively rotatable relative to handpiece **12***a* using only two of the practitioner's fingers. Thus, the orientation of the tip **20***e* can be continuously altered with only two of the practitioner's fingers, requiring only one hand, while the scaling operation proceeds. This will reduce operator fatigue and substantially shorten the time necessary for the scaling process. The expected torque needed to rotate insert **20** preferably will be less than 2.0 inch-oz.

When the practitioner has concluded the de-plaqueing process, the insert **20** can be removed from the handpiece by pulling it axially from the handpiece in a direction **16***b* and sterilized. The same insert or a different insert can then be subsequently inserted into handpiece **12***a* to treat the next patient. It will be understood that the present invention is applicable to ultrasonic inserts which utilize either magnetostrictive or piezoelectric transducers without limitation.

FIGS. **3**A, **3**B, **3**C illustrate different views of the body **20***b* of the insert **20**. As illustrated in FIGS. **3**A and **3**B, body portion **20***b* is attached to a first end **20***a*-**1** of transducer **20***a* as would be understood by those of skill in the art. An elongated cylindrical extension **20***b*-**1** extends axially from transducer **20***a* toward tip **20***e*.

The elongated cylindrical metal member **20***b*-**1**, as would be known to those of skill in the art, is caused to vibrate axially, in response to electro-magnetic signals received at transducer **20***a* from handpiece **12***a*. The signals are produced by generator **12***c*. This axial ultrasonic vibration is in turn coupled to the tip **20***e* and used for effecting de-plaqueing of the subject tooth T, in a spray of fluid M, illustrated in phantom in FIG. **3**C.

A pair of notches **20***b*-**2**, **20***b*-**3** is formed on elongated body member **20***b*-**1** in a region of substantially zero axial ultrasonic vibration. While a pair of notches **20***b*-**2**, -**3** has been illustrated in FIG. **3**B, it will be understood that a single notch, or three notches could be used without departing from the spirit and scope of the present invention. Additionally, the exact shape of the generally rectangular notches **20***b*-**2**, -**3** is not a limitation of the present invention.

An interior or base plane **20***b*-**2**', **20***b*-**3**' of each notch **20***b*-**2**, -**3** is parallel to a plane through the central axis of tip **20***e*. This notch/tip configuration facilitates energy transmission along insert **20** without increasing the risk of a mechanical fracture due to potential fatigue stress.

An elongated fluid flow slot **20***b*-**4** extends axially in the region where the body **20***b*-**1** interfaces with the tip **20***e*. As discussed subsequently, fluid for the spray M flows therethrough.

FIGS. **4**A, B, C and D illustrate different views and additional details of rotary bearing **24**. As illustrated therein, the cylindrical stem **24***a* is hollow and defines an interior peripheral surface **24***e* which is adjacent to the elongated body portion **20***b*, see FIG. **2**A. The bearing member **24** carries a second O-ring **24***c*-**1** in a cylindrical region **24***d*-**2** which is adjacent to a plurality of radially disposed spring-loaded fingers indicated generally at **24***g*.

The fingers **24***g* each terminate at a barbed free end, such as **24***g*-**1**, -**2**, -**3** with preferably four such fingers disposed radially about the annular surface **24***d*-**2**. Neither the number nor the exact shape of the ends **24***g*-**1**, -**2** . . . -n are limitations of the present invention. As discussed in more detail subsequently, the fingers **24***g*-**1**, -**2**, -**3**, -**4** are deflectable radially inward during assembly and are biased radially outwardly to return to their undeflected condition, illustrated in FIGS. **4**A, **4**B.

The second O-ring **24***c*-**1** which is positioned adjacent annular surface **24***d*-**2** cooperates with O-ring **24***c* to provide a sealed fluid flow path between handpiece **12***a* and cone **20***d*. Cooling fluid flows from handpiece **12***a* through aperture **24**-**1**, FIG. **4***c*, and past the fingers **24***g*-**1**, -**2**, -**3**, -**4**. It will be understood that the number of fingers **24***g* is not a limitation of the present invention.

FIGS. **5**A–**5**D illustrate various views of a torque lock **30** which couples a torque due to force applied to deformable gripping member **20***c* by the user's fingers to the body **20***b* and treatment tip **20***e*. The torque lock **30** is preferably molded of a sterilizable thermoplastic which, as discussed below, permits it to deform during assembly without fracturing.

The torque lock **30** has a hollow body section **32***a* with an exterior periphery **32***b* and an internal circumferential periphery **32***c*. The torque lock is molded with a slot **34***a* formed in the body **32***a* which permits outward radial deformation of sections **34***b* and **34***c*, adjacent the slot **34***a*, as the torque lock **30** is slid onto the elongated body portion **20***b*-**1**. Surfaces **36***a*, **36***b* slidably engage the notches **20***b*-**2**, -**3** of the elongated member **20***b*-**1**. When the notches are so-engaged, the deformable members **34***b*, c move radially inwardly to a non-deformed condition. In this state, torque lock **30** is locked to the body **20***b* at the notches **20***b*-**2**, -**3**.

The interaction between the surfaces **36***a, b*, in the slots **20***b*-**2**, -**3** inhibits both rotation and translation of the torque lock **30** relative to the body member **20***b*-**1**. Hence, rotating the torque lock **30** will also rotate the body **20***b* of the insert.

Once the torque lock **30** has been installed on the body member **20***b*-**1** at the slots **20***b*-**2**, -**3**, it will be fixedly located at a region of substantially zero axial ultrasonic vibration. This minimizes a build-up of heat between the vibrating body **20***b*-**1** and the torque lock **30**. As will be understood by those of skill in the art, in addition to locating the notches **20***b*-**2**, -**3** at a region of minimal axial ultrasonic vibration, preferably centered on the expected nodal point of zero vibration, the cross section of the connecting body portion **20***b*-**1** through the notches **20***b*-**2**, -**3** will have a large enough cross-sectional area to transmit ultrasonic vibrations without constriction.

FIGS. **6**A, B, C illustrate various views of a housing **40** which is press fit over torque lock **30** and which slidably and lockingly engages barbed fingers **24***g*-**1**, -**2**, -**3**, and -**4** of the rotary bearing **24**. The housing **40** has an elongated generally cylindrical body **42***a* with a smooth exterior periphery **42***b*. The body **42***a* terminates at an end **42***c* adjacent an annular shoulder **42***d*.

The shoulder **42***d* in turn has an end surface **42***d*-**1**. When installed, the end surface **42***d*-**1** is adjacent to and rotates relative to annular surface **24***d*-**3** of bearing **24**.

The annular member **42***d* exhibits an internal cylindrical peripheral surface **42***d*-**2** which traps O-ring **24***c*-**1** in position, forming a fluid seal with bearing **24** when surface **42***d*-**1** is positioned adjacent to surface **24***d*-**3**. When so-positioned, the housing **40** can rotate relative to bearing **24** but is not movable axially relative thereto.

When the housing **40** is rotated relative to the bearing **24**, the surface **42***d*-**2** slides over O-ring **24***c*-**1** without excessive friction thereby enabling a practitioner to rotate the tip **20***e* relative to the handpiece **12***a* with the use of force applied to elastomeric gripping member **20***c* by only two fingers.

The housing **40** has an interior, cylindrical peripheral surface **42***b*-**1** which surface deflects the barbed fingers **24***g*-**1**, -**2**, -**3**, -**4** radially inwardly when the housing **40** is slid onto the fingers **24***g*. The fingers **24***g*, which have been inwardly radially deflected by the surface **42***b*-**1** engage a cylindrical slot **42***b*-**2** with a snap fit. The radially compressed fingers **24***g* expand outwardly radially and the barbed ends **24***g*-**1**, -**2**, -**3**, -**4** lock into the slot **42***b*-**2** precluding axial motion of the housing **40** away from surface **24***d*-**3** of bearing **24**.

As the housing **40** is slidably engaging the barbed fingers **24***g*-**1**, -**2**, -**3**, -**4** and internal cylindrical peripheral surface **42***b*-**3** engages exterior cylindrical peripheral surface **32***b* of torque lock **30** with a press or interference fit. The press fit

between torque lock **30** and housing **40** locks those two parts together precluding either axial linear movement or rotary movement therebetween. The end **42***b* of housing **40** carries a plurality of threads **42***b*-**4**.

The snap fit between the housing **40** and the rotary bearing **24**, in combination with the O-ring **24***c*-**1** provide a sealed fluid flow path from inflow periphery **24***e* of bearing **24** through outflow end surface **42***b*-**5** of housing **40**. This fluid flow seal, as noted above, precludes fluid leakage. The exterior cylindrical surface **24***g*' of each of the fingers **24***g* rotatably engages the internal cylindrical surface **42***b*-**1** of the housing **40**. This provides a pair of rotatable bearing surfaces which permit smooth two finger rotation of the deformable member **20***c* and the treatment tip **20***e*. A medically acceptable, sterilizable, lubricant is preferably provided between the bearing surfaces to improve rotational smoothness and further reduce friction and required torque.

FIGS. **7**A and **7**B are views of cone **20***d* which is carried by rotatable housing **40**. Cone **20***d* has an internal flow path **50***a* which is sealed by O-ring **50***b*. Cone **20***d* includes a set of threads **52**. Cone **20***d* is coupled to housing **40** by the rotatable engagement of threads **42***b*-**4** of housing **40** and **52** of cone **20***d*.

The O-ring **50***b* precludes leakage between an end **50***c* and a region of body portion **20***b*-**1** which extends therethrough. Fluid exits cone **20***d* via fluid flow channel **20***b*-**4** in the body portion **20***b*- **1**. Fluid exits the cone **20***d* in the channel **20***b*-**4** as a stream. The stream of fluid impacts the vibrating tip **20***e* and creates a smooth spray pattern M suited for cooling and cleaning tissues. Adhesives, such as epoxy, can be used to permanently attach the cone **20***d* to the housing **40**.

FIGS. **8**A, **8**B and **8**C illustrate the steps of assembly of the insert **20**. Groove **20***b*'-**1** in body section **20***b*' provides a positive gripping surface usable during assembly by manufacturing fixtures to block axial movement of the insert **20**.

As illustrated in FIG. **8**A, initial steps of assembly of the insert **20** include sliding rotary bearing member **24** past operative tip **20***e* onto body portion **20***b*-**1**. The torque lock **30** is then slid onto the operative element **20***e* and forced along the elongated body **20***b*-**1**, which in turn forces elements **34***b, c* radially outward until surfaces **36***a, b* thereof slidably engage the slots **20***b*-**2**, -**3**. This slidable engagement with the slots in the body member **20***b* locks the torque lock **30** to the body member **20***b* and traps the bearing member **24** against a portion **20***b*' of the body **20***b* precluding axial movement thereof. The bearing member **24** continues to be rotatable relative to the elongated body portion **20***b*.

As illustrated in FIG. **8**B, the housing **40** is then slid onto and past the operative element **20***e* and forced onto the rotary bearing **24**, thereby radially inwardly deflecting the barbed fingers **24***g*-**1**, -**2**, -**3**, -**4** and also press fit onto external peripheral surface **32***b* of torque lock **30** adjacent to disc **24***d*. When seated on the bearing member **24**, the inwardly deflected fingers **24***g* expand into radial slot **42***b*-**2**, axially locking the housing **40** to the bearing **24** while still permitting relative rotary motion therebetween.

The circular elastomeric gripping member **20***c* can be slid onto housing **40** either before or after the cone **20***d* is threadably engaged therewith. The gripping region **20***c* has an inner diameter which is slightly smaller than the outer diameter of the housing **40**. The member **20***c* thus elastically attempts to contract around the housing **40** which minimizes unintended slippage of the grip **20***c* relative to the housing **40**. Member **20***c* can also be permanently attached to housing **40** with adhesive.

FIG. **9**A illustrates a side sectional view of an assembled insert **20** in accordance with the method of steps of FIGS. **8**A, B and C. FIG. **9**B is an enlarged side sectional view of a portion of FIG. **9**A further illustrating the relationships of the various elements therein.

As will be understood by those of skill in the art, preferably tip **20***c* will be formed and heat treated prior to the start of the assembly process illustrated in FIG. **8**A. By forming housing **40** as a separate element from core **20***d*, the length of each is less than the combined length of **20***d* and **40**. Hence, each can be independently slid over exemplary curved tip **20***e* though the assembled combination **20***d* and **40** will not slide over tip **20***e*.

FIG. **10**A illustrates a snap-on plastic adaptor **70** which is intended to be used with a standard handpiece, such as the handpiece **12***a*. As illustrated in FIG. **10**A, handpiece **12***a* includes an annular depression **12***c* adjacent to open end **12***a*-**2**. The adaptor **70** snap-fits onto the handpiece **12***a* at the groove **12***c*.

Adaptor **70** has a body section **72***a* which carries an annular locking protrusion **72***b* which slidably engages the slot **12***c* locking the adaptor **70** thereto. The adaptor **70** also includes a bearing **74***a* which is carried in an interior region **74***b* of the body **72***a*. An O-ring seal **74***c* can be positioned adjacent to the bearing **74***a* to minimize the likelihood of leakage from fluid flowing through the handpiece **12***a* into an insert coupled thereto.

The insert **70** defines a channel **76***a* which co-extends with and abuts channel **12***d* in handpiece **12***a*. The channels **76***a* and **12***d* receive a standard insert such as the insert **14**, which is to be rotatably coupled to handpiece **12***a* and to be energized thereby.

FIG. **10**B illustrates added details of standard insert **14** coupled to adaptor **70** for rotation relative to handpiece **12***a*. In the embodiment illustrated in FIG. **10**B, the adaptor **70** in combination with handpiece **12***a* and insert **14** provide a sealed fluid flow path between the interior peripheral surface **12***b* of the handpiece and tip **14***b* of the insert. In this configuration, a user can rotate insert **14** relative to handpiece **12***a* by applying rotary forces to the grip **14***c* in a manner analogous to the way in which rotary forces are applied to the grip **20***c* of rotatable insert **20** previously described.

Using insert **70**, a standard handpiece, in combination with standard inserts, such as the insert **14**, can cost effectively provide improved convenience and comfort for the practitioner. It will be understood, if desired, that the insert **70** could be color coded. The insert **70** can be molded of any sterilizable plastic such a thermoplastic material commercially available and known as polyphenylsulfone. It will also be understood that a plurality of snap-fit fingers, such as the fingers **72***b*, can be molded in housing **72***a* for purposes of releasibly attaching the adaptor to the handpiece **12***a*.

FIG. **10**C is an over-all view of insert **14** coupled to handpiece **12***a* via adaptor **70**.

FIGS. **11**A and **11**B illustrate an alternate form of an adaptor **80** usable with a handpiece **82**. The adaptor **80** includes a cylindrical body section **80***a* which carries a bearing **80***b* which could be implemented as a plastic ring bearing. The bearing **80***b* is carried in a cylindrical slot **80***c* in housing **80***a*.

Housing **80***a* also carries an O-ring seal **80***d* in a second slot **80***e*. Finally, the body **80***a* terminates at a plurality of deflectable locking fingers **80***f*. The body **80***a* is hollow and defines an internal peripheral cylindrical surface **80***g*.

Insert **80** is slidably receivable into handpiece **82** with a snap-fit. The exterior surfaces of the fingers **80***f* slidably

engage a locking slot **82***a* formed in an interior peripheral surface **82***b* of the handpiece **82**. The interior peripheral surface **82***b* also includes a slot **82***c* for receipt of the O-ring seal **80***e*, and, a slot **82***d* which receives the rotary bearing **80***b* carried by the insert **80**. It will be understood that the O-ring **80***d* provides a fluid seal between handpiece **82** and an insert, such as the insert **14** shown in part in phantom, which has been slidably inserted into the adaptor **80** in contact with the internal peripheral cylindrical surface **80***g*. When so-inserted, the insert **14** can be rotated, along with adaptor **80** relative to the handpiece **82** so as to promote the convenience and comfort of a practitioner. A collar **86** is threadable onto the end of the handpiece **82** to trap the adaptor **80** in place and prevent axial movement thereof.

FIGS. **12**A–C illustrate details of a preferred structure of stack **20***a*. By impressing a "W" bend **20***a*-**1** along the length of each member of the stack, as illustrated, stiffness of the stack can be increased. This in turn promotes continued alignment of the stack relative to central axis HP-A, see FIG. **2**B, while the insert **20** is being rotated. The improved alignment minimizes the likelihood of the stack **20***a* rubbing against internal peripheral surface **12***d* during rotation, hence eliminating a possible source of friction and noise.

From the foregoing, it will be observed that numerous variations and modifications may be effected without departing from the spirit and scope of the invention. It is to be understood that no limitation with respect to the specific apparatus illustrated herein is intended or should be inferred. It is, of course, intended to cover by the appended claims all such modifications as fall within the scope of the claims.

What is claimed:

1. An ultrasonic insert which is engageable with a hollow handpiece, the insert comprising:

a treatment applying tip;

an ultrasonic transducer coupled to the tip;

a rotary bearing carried between the transducer and the tip wherein the bearing is rotatable relative to the tip and which includes an elongated member extending between the tip and the transducer wherein the bearing is rotatably carried on the member adjacent to a portion of the transducer.

2. An insert as in claim **1** which includes a locking element which blocks the bearing from axial movement while permitting the rotary movement.

3. An ultrasonic insert which is engageable with a hollow handpiece, the insert comprising:

a treatment applying tip;

an ultrasonic transducer coupled to the tip;

a rotary bearing carried between the transducer and the tip wherein the bearing is rotatable relative to the tip, the bearing comprises a cylindrical sleeve rotatably carried adjacent to an end of the transducer; and

which includes an elongated member extending between the tip and the transducer wherein the bearing is rotatably carried on the member adjacent to a portion of the transducer.

4. An ultrasonic insert which is engageable with a hollow handpiece, the insert comprising:

a treatment applying tip;

an ultrasonic transducer coupled to the tip;

a rotary bearing carried between the transducer and the tip wherein the bearing is rotatable relative to the tip, the bearing comprises a cylindrical sleeve rotatably carried adjacent to the end of the transducer; and

wherein the sleeve includes an exterior feature slidably engageable with the handpiece.

5. An insert as in claim **4** wherein the exterior feature comprises an annular elastomeric member.

6. A rotatable ultrasonic dental insert comprising:

a treatment applying tip, a transducer non-rotatably coupled to the tip and a handpiece engaging element, rotatably coupled to the tip, wherein the tip is rotatable relative to the engaging element by a force applied adjacent to the tip, and which carries a user comfortable, deformable, elastomeric member whereby the user can rotate the tip relative to the engaging element.

7. An insert as in claim **6** which includes an elongated body with an end coupled to the tip and a torque transferring cylinder coupled between a portion of body and the elastomeric member whereby the cylinder is mechanically looked to the body such that a rotary force applied to the elastomeric member establishes a torque for rotating the body.

8. An insert as in claim **6** wherein the engaging element is coupled to the tip at a region of minimal axial ultrasonic vibration.

9. An insert as in claim **8** wherein the engaging element includes a cylindrical bearing which is slidably lockable in a handpiece.

10. An insert as in claim **6** wherein the engaging element includes a rotary bearing positioned adjacent to the elastomeric member whereby the tip and elastomeric member are rotatable together relative to a portion of the engaging element.

11. An insert as in claim **10** wherein the bearing is located at least in part, adjacent to a region of minimal axial ultrasonic vibration.

12. An insert as in claim **10** wherein the tip is rotatable through an arc on the order of at lest two hundred seventy degrees.

13. A rotatable ultrasonic dental insert comprising:

a treatment applying tip, and a transducer, the tip and transducer are non-rotatably coupled together by an intervening coupling section, and a handpiece engaging element, rotatably carried, at least in part, on the coupling section, wherein the tip is rotatable relative to the engaging element by a force applied adjacent to the tip, and which carries a user comfortable, deformable, elastomeric member whereby the user can rotate the tip relative to the engaging element.

14. An insert as in claim **13** which includes a cylinder coupled between a portion of coupling section and the elastomeric member whereby the cylinder is mechanically locked to the coupling section such that a rotary force applied to the elastomeric member establishes a torque for rotating the tip.

15. An insert as in claim **13** where the engaging element is located at least in part, adjacent to a region of minimal axial ultrasonic vibration.

16. An insert as in claim **13** where the tip is rotatable through an arc on the order of at least two hundred seventy degrees.

* * * * *

EXHIBIT B

US007011520B2

(12) **United States Patent**
Rahman et al.

(10) **Patent No.: US 7,011,520 B2**
(45) **Date of Patent: Mar. 14, 2006**

(54) **TWO PART ULTRASONIC SWIVEL INSERT, WITH ONE PART ROTATABLE RELATIVE TO THE OTHER**

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Related U.S. Application Data

(62) Division of application No. 09/917,101, filed on Jul. 27, 2001, now Pat. No. 6,716,028.

(60) Provisional application No. 60/223,447, filed on Aug. 4, 2000, provisional application No. 60/270,687, filed on Feb. 22, 2001.

(51) **Int. Cl.**
A61C 1/07 (2006.01)

(52) **U.S. Cl.** **433/86**

(58) **Field of Classification Search** 433/119, 433/118, 86, 81, 102
See application file for complete search history.

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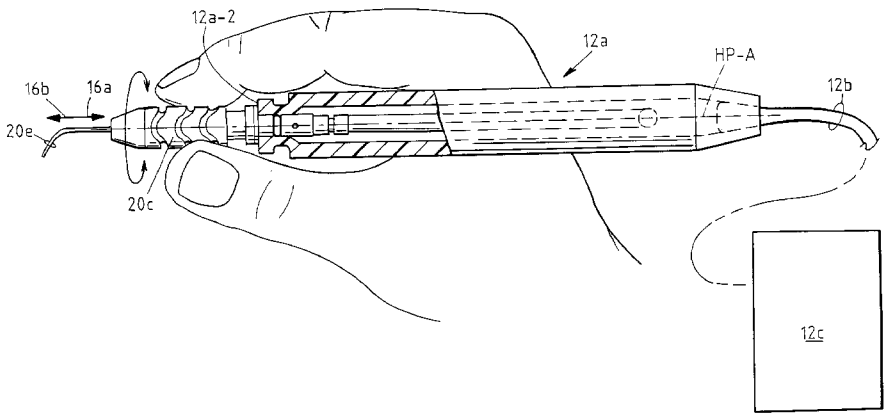
(57) **ABSTRACT**

An ultrasonic insert carries a rotary bearing adjacent to the transducer. The bearing slidably engages an ultrasonic handpiece. When seated in the handpiece, the insert is substantially decoupled, on a rotary axis, from the handpiece. A rotary force need only be applied to the insert to rotate it in the handpiece. Alternately, an adaptor can be inserted into the handpiece. The adaptor slidably receives a conventional ultrasonic insert. The conventional insert can be easily rotated with a force applied only thereto, relative to the handpiece.

34 Claims, 15 Drawing Sheets



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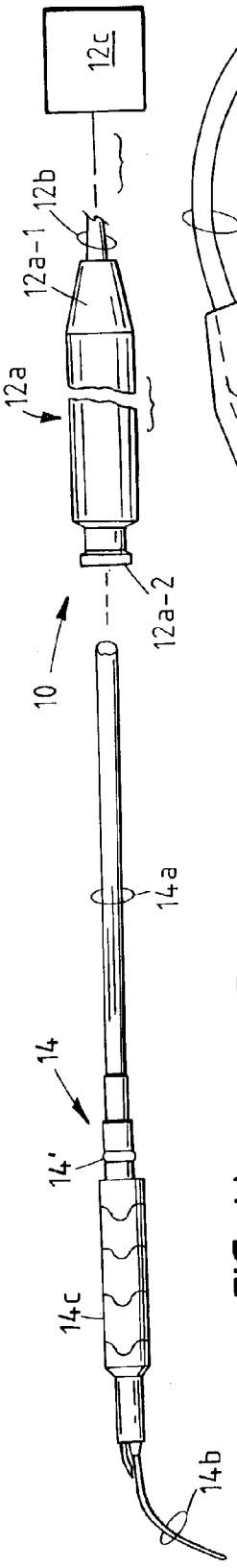


FIG. 1A PRIOR ART

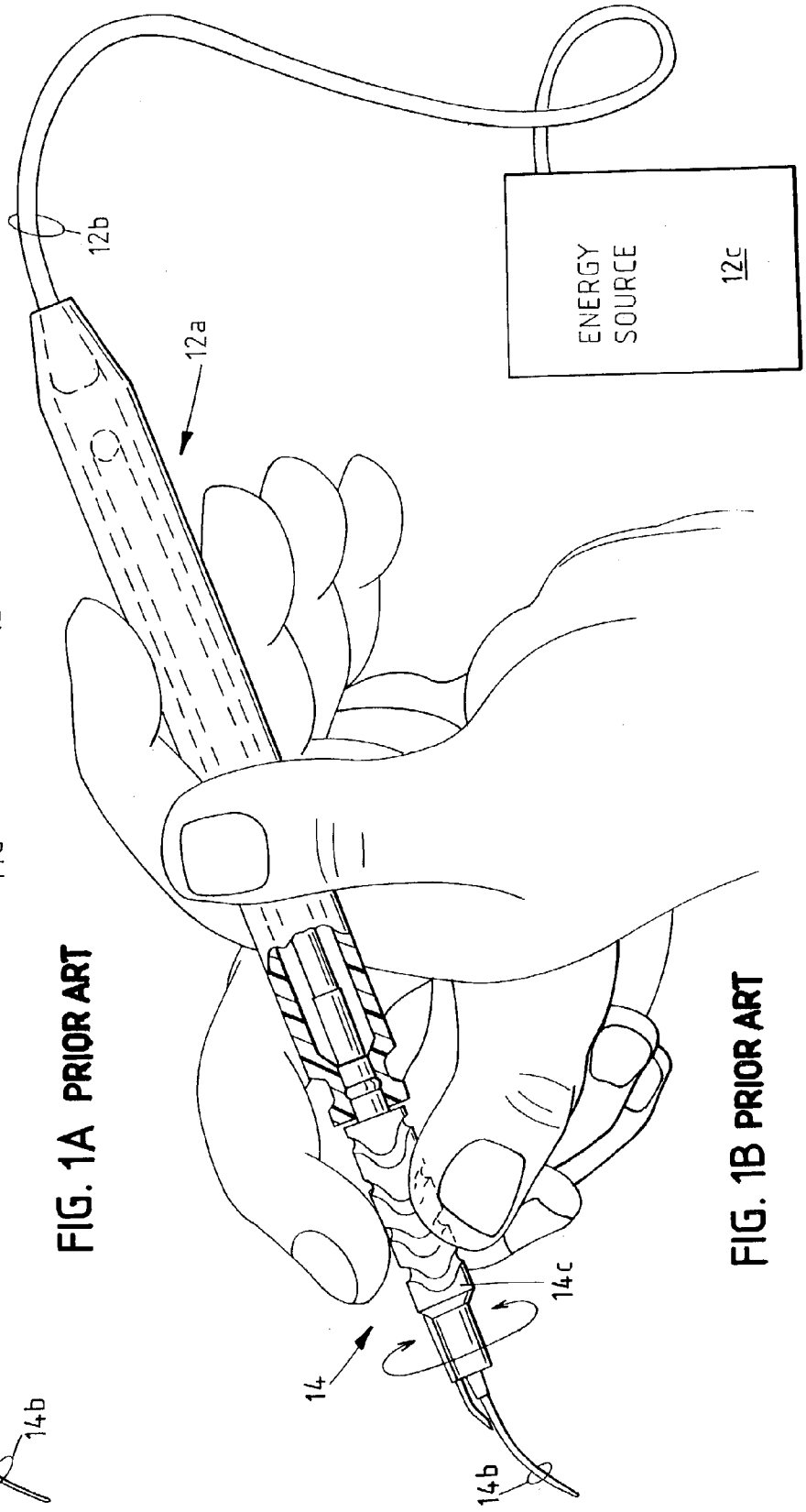


FIG. 1B PRIOR ART

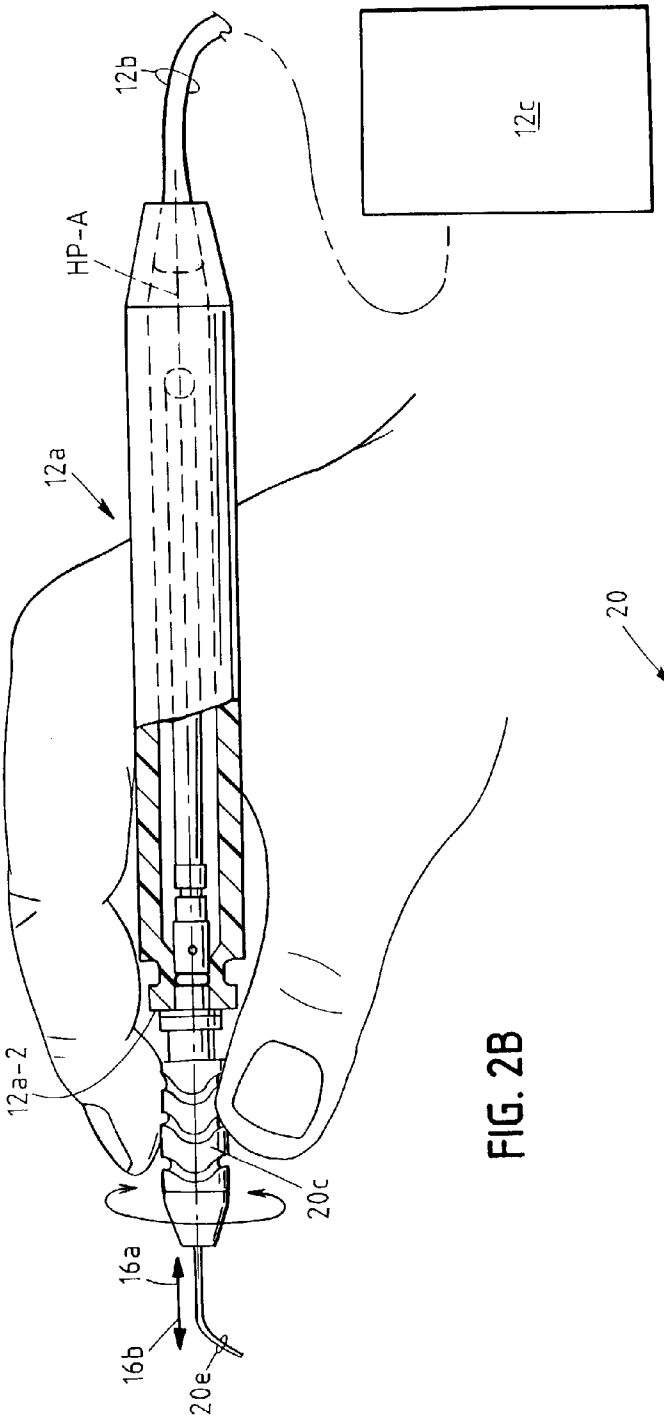

12b
12c
HP-A
12a
12a-2
20c
16a
16b
20e

FIG. 2B

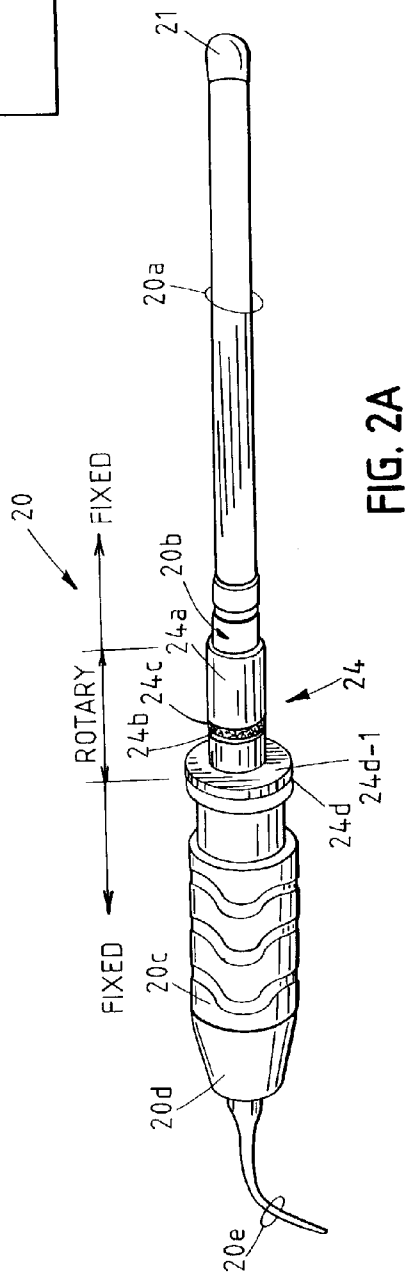

21
20a
20
FIXED
20b
24a
24c
24b
ROTARY
24
24d-1
24d
FIXED
20c
20d
20e

FIG. 2A

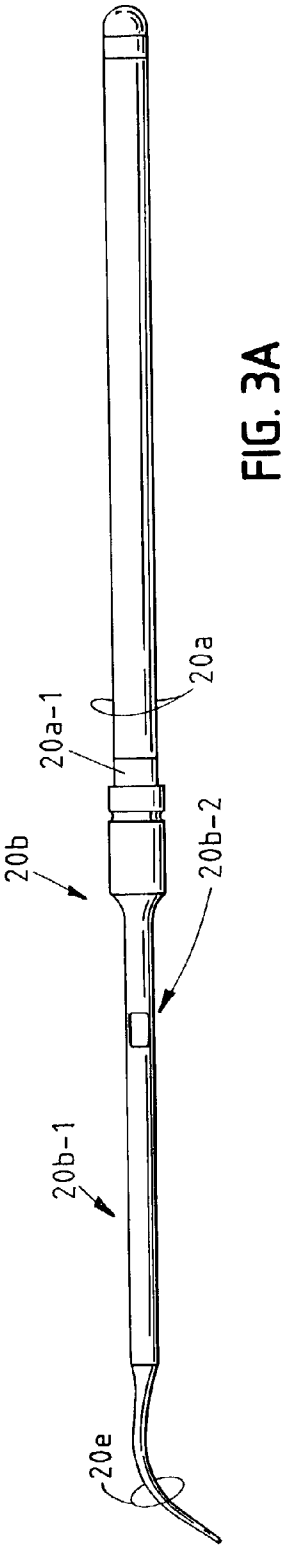


FIG. 3A

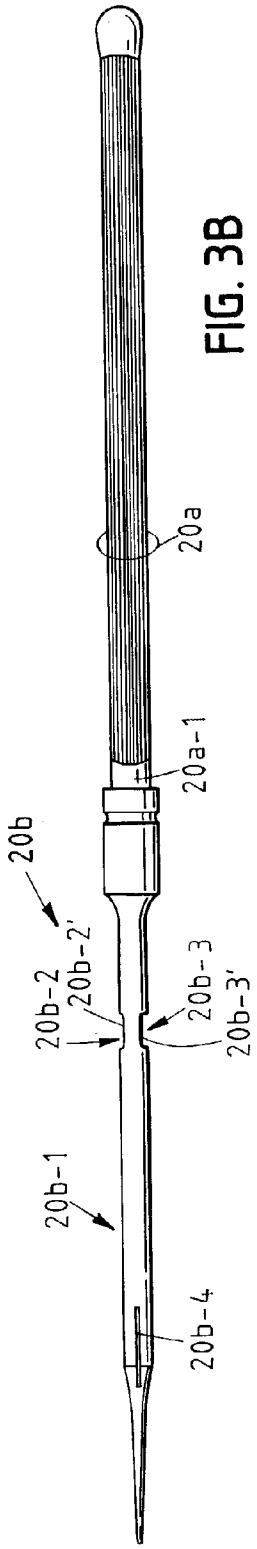


FIG. 3B

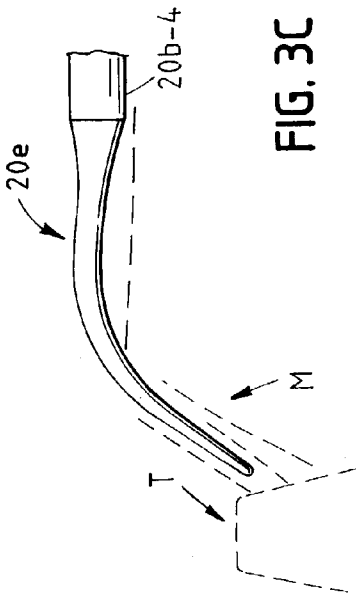


FIG. 3C

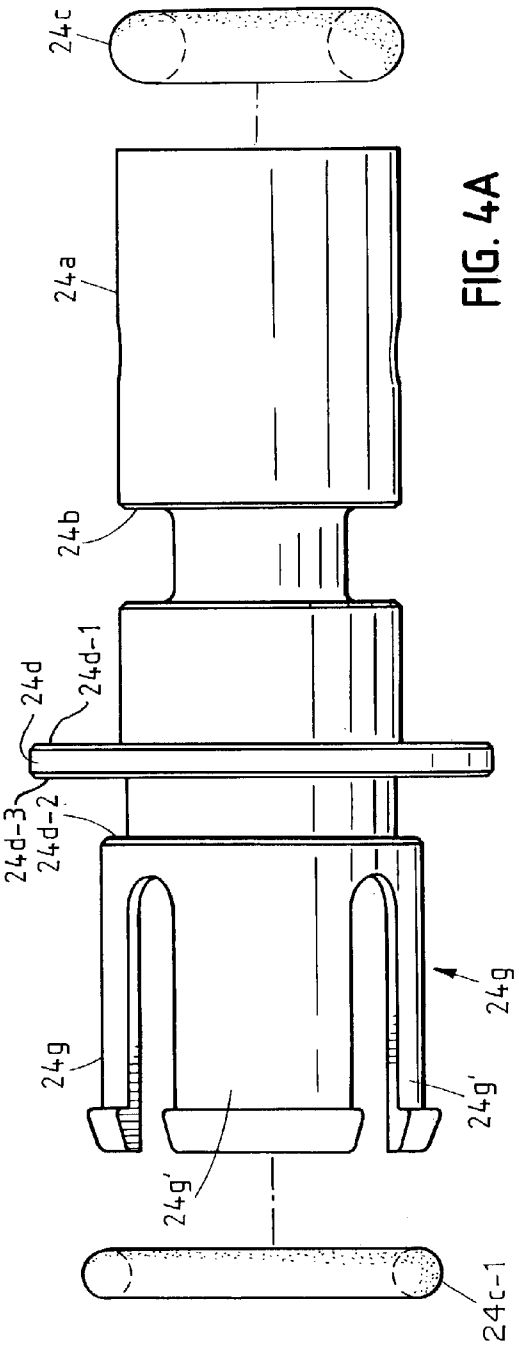

24c
24a
24b
24d-1
24d
24d-3
24d-2
24g
24g'
24g
24g'
24c-1

FIG. 4A

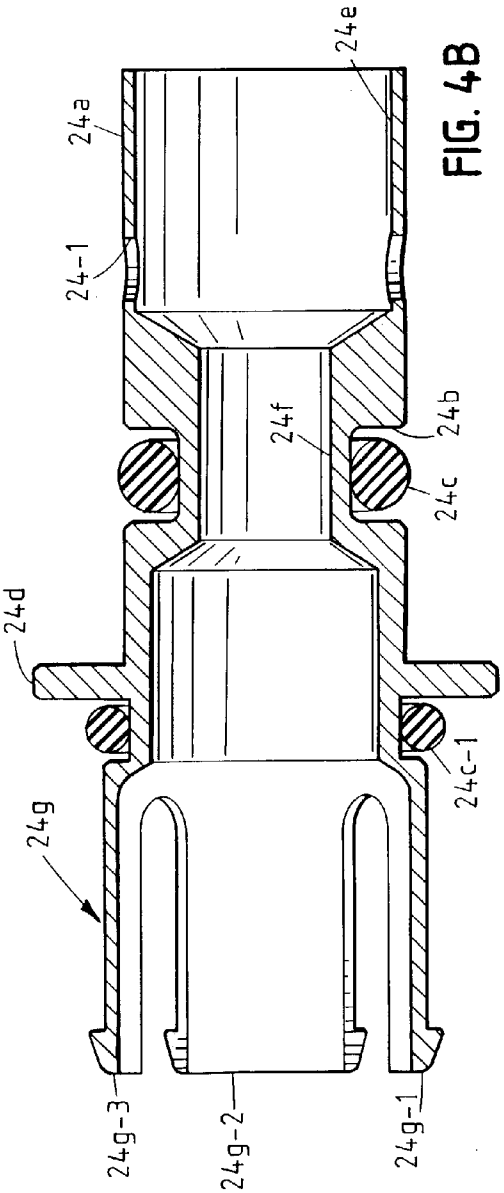

24e
24a
24-1
24f
24b
24c
24d
24c-1
24g
24g-3
24g-2
24g-1

FIG. 4B

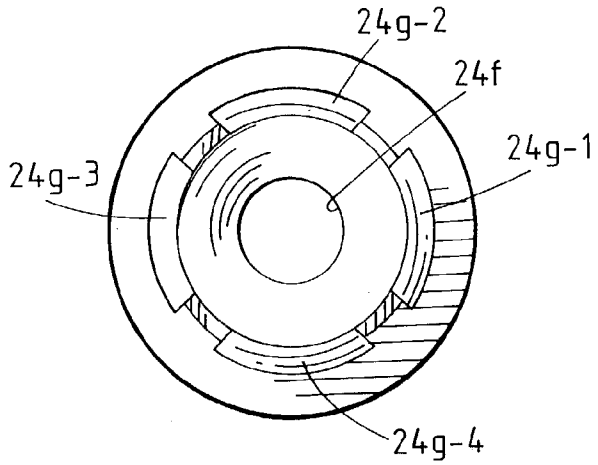


FIG. 4D

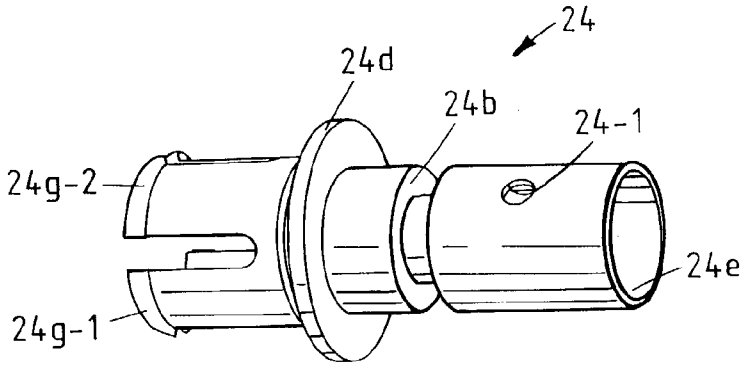


FIG. 4C

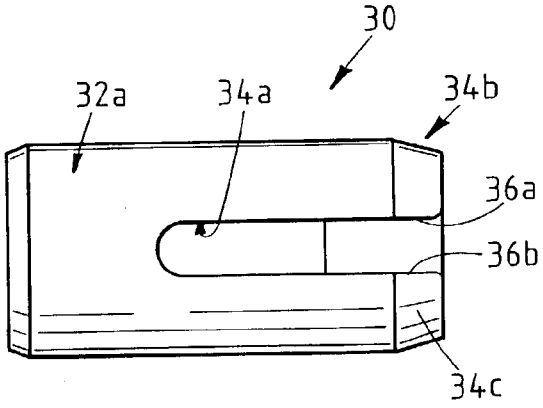


FIG. 5A

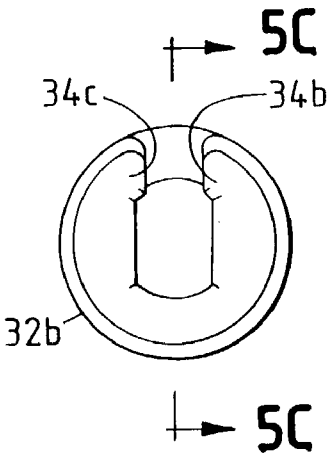


FIG. 5B

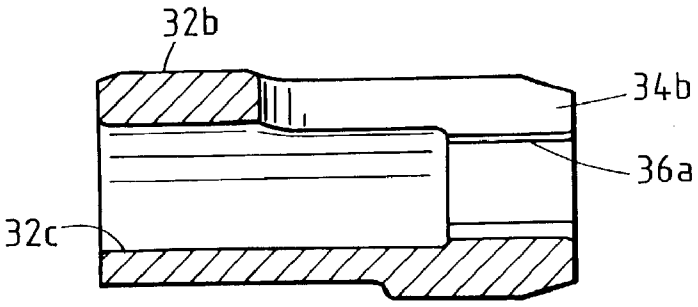


FIG. 5C

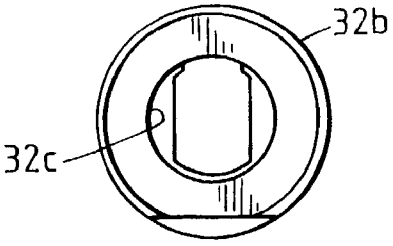


FIG. 5D

FIG. 6A

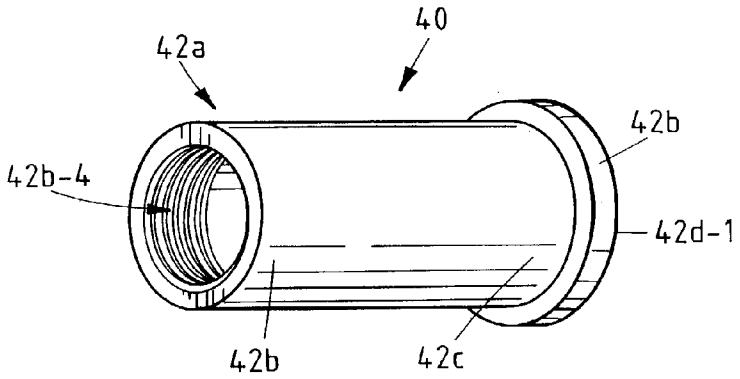


FIG. 6B

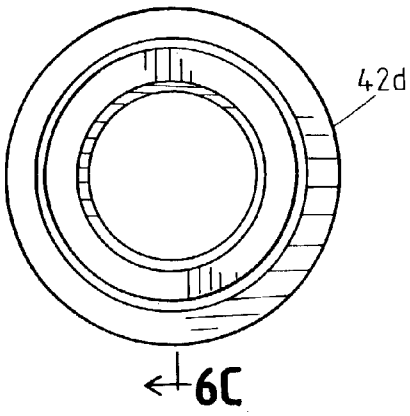
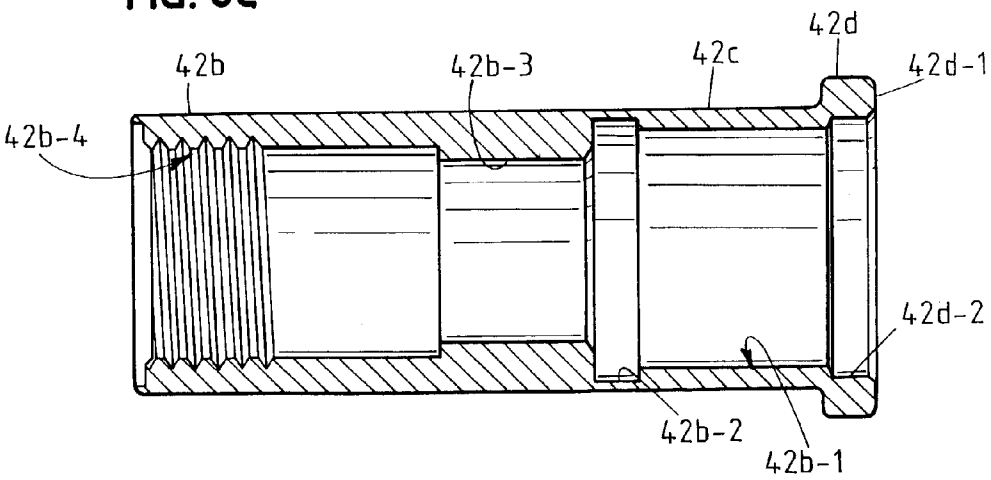


FIG. 6C



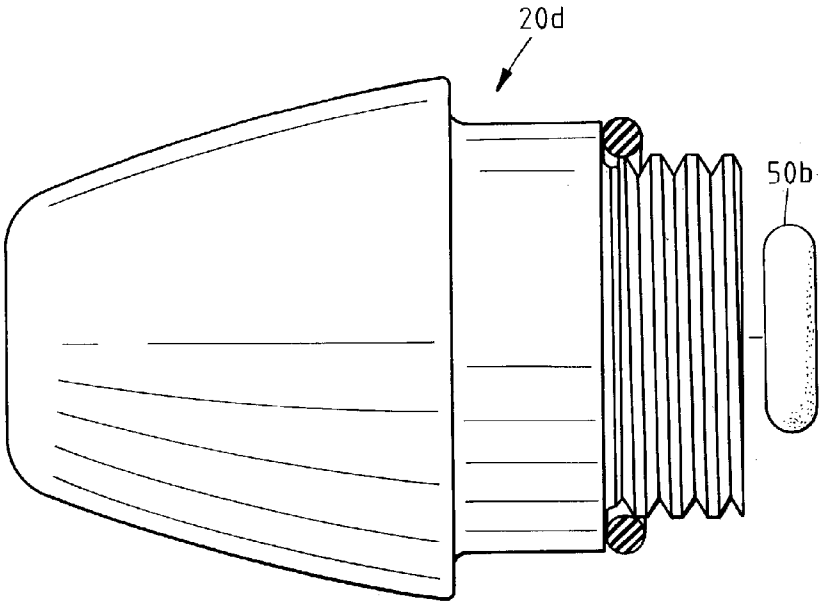


FIG. 7A

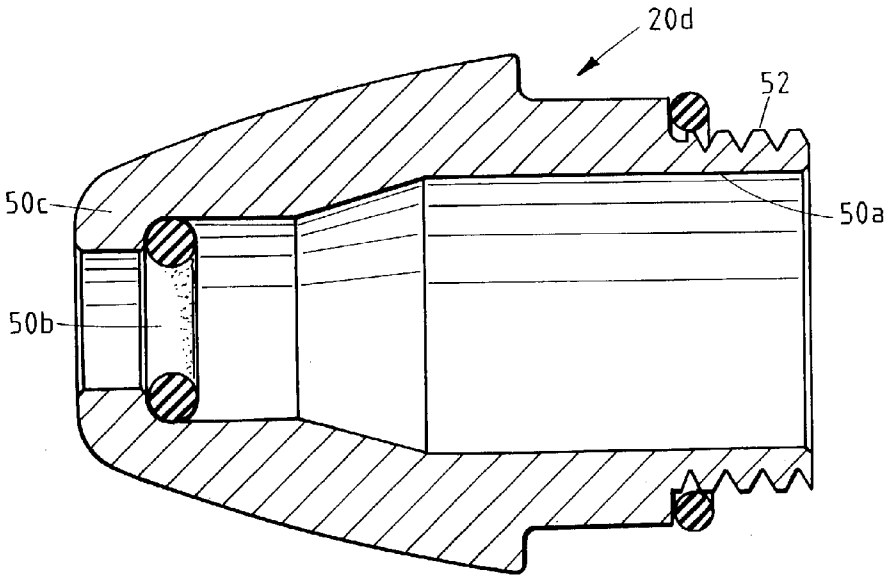
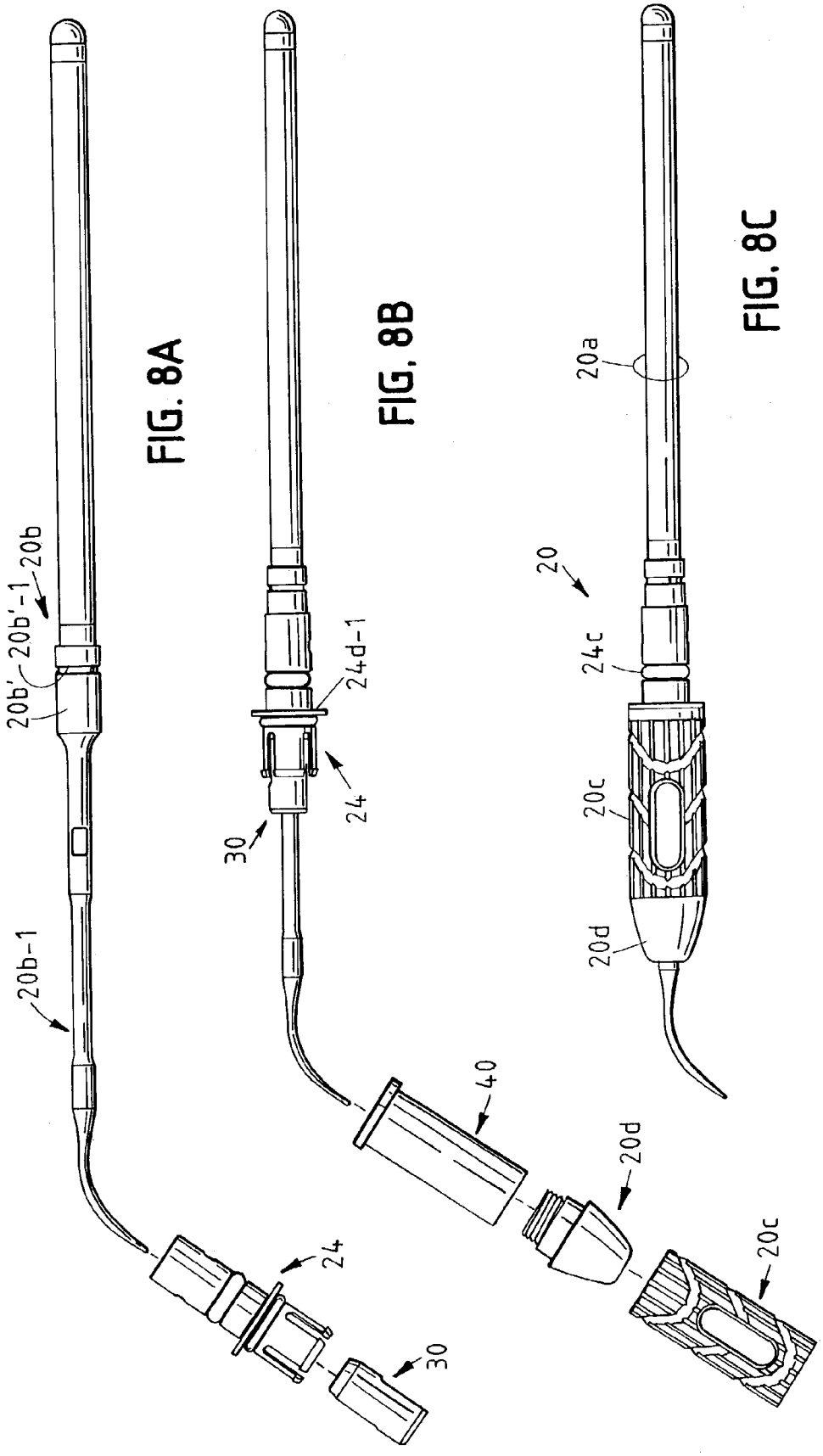


FIG. 7B


20b
20b'-1
20b'
20b-1
24
30
FIG. 8A
24d-1
24
30
FIG. 8B
20a
20
24c
20c
20d
FIG. 8C
40
20d
20c
24
30

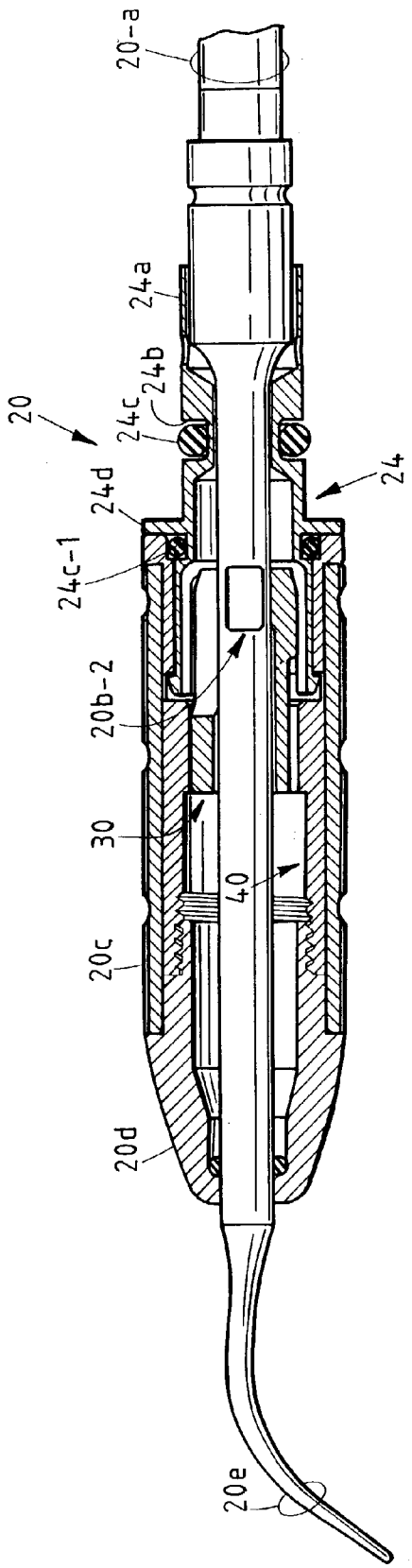


FIG. 9A

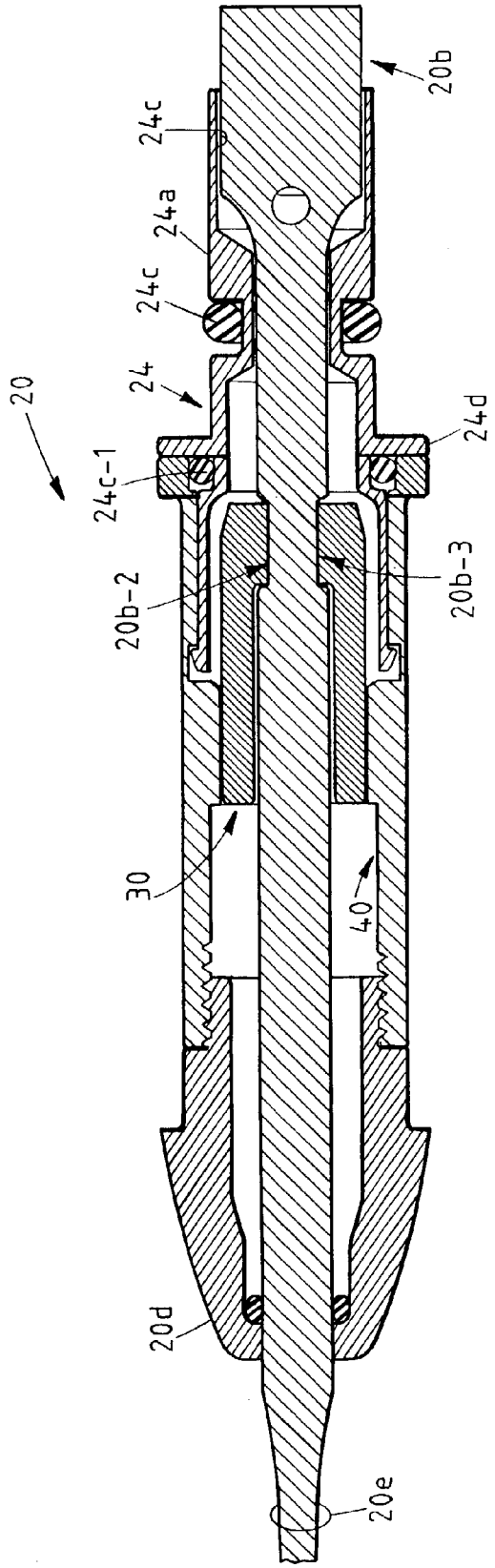


FIG. 9B

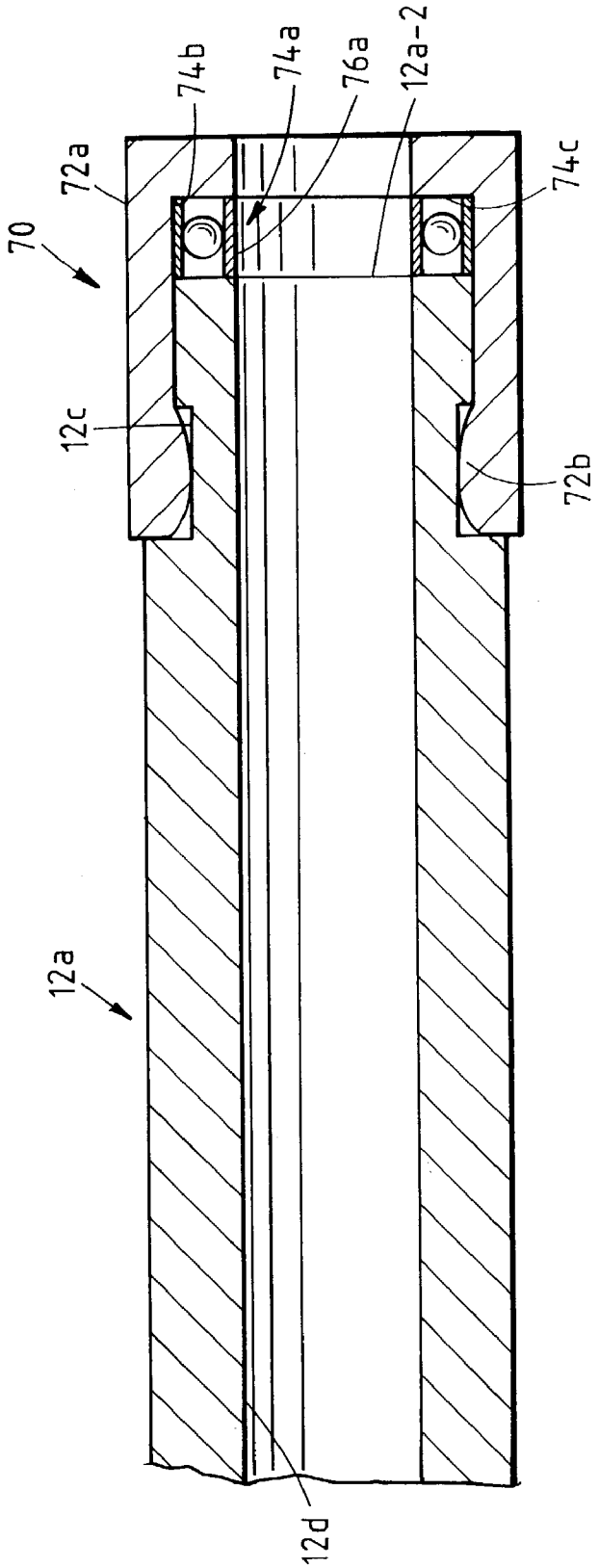


FIG. 10A

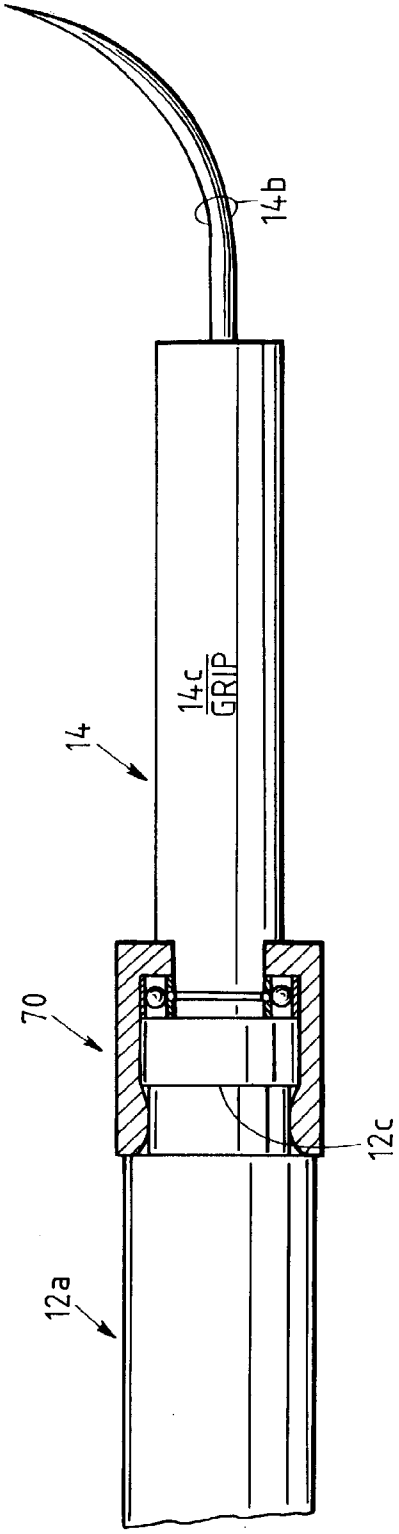


FIG. 10B

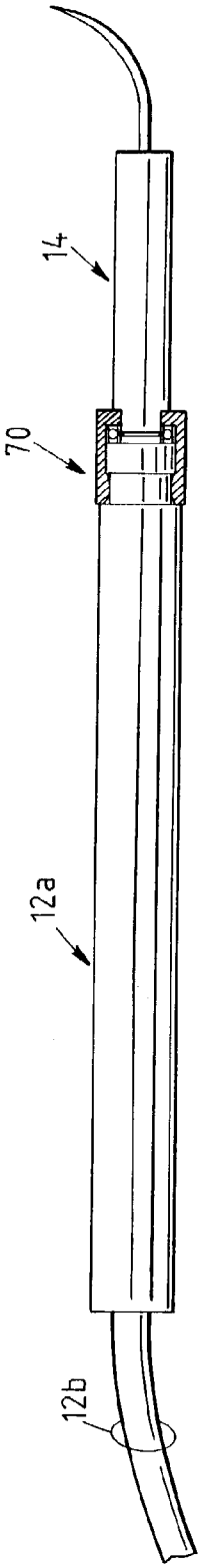


FIG. 10C

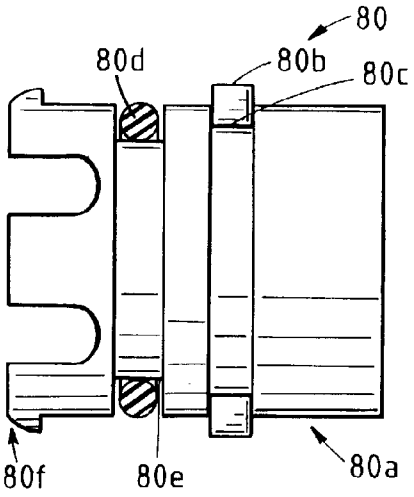


FIG. 11A

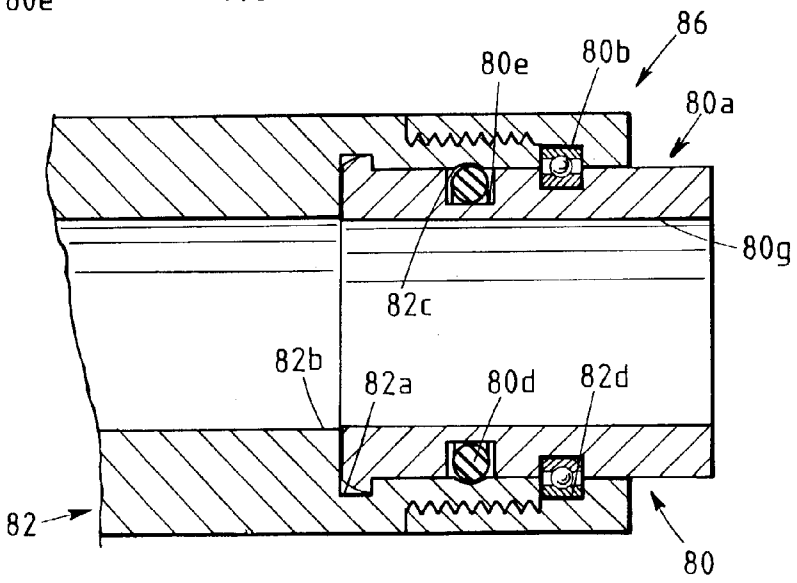


FIG. 11B

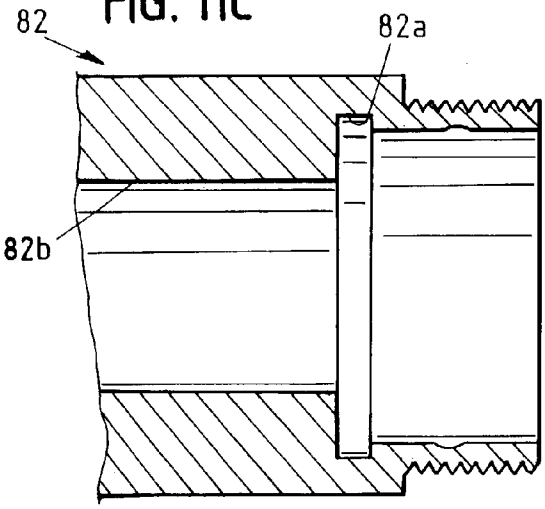


FIG. 11C

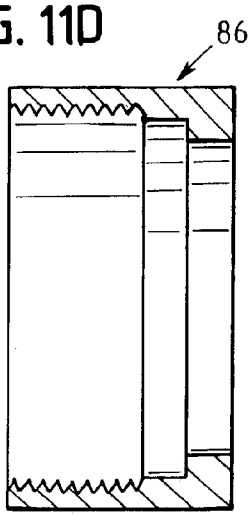


FIG. 11D

FIG. 12A

FIG. 12B

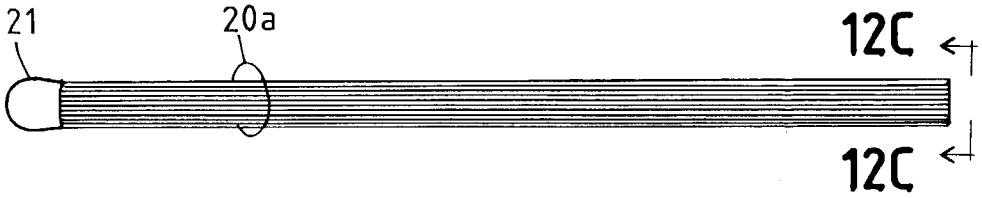
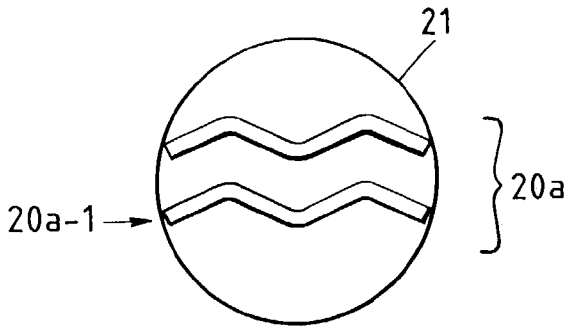


FIG. 12C



TWO PART ULTRASONIC SWIVEL INSERT, WITH ONE PART ROTATABLE RELATIVE TO THE OTHER

This is a Divisional Application claiming the benefit of the earlier filing date of Utility application Ser. No. 09/917,101, filed Jul. 27, 2001, now U.S. Pat. No. 6,716,028 which claimed the benefit of the earlier filing dates of Provisional Application Ser. No. 60/223,447, filed Aug. 4, 2000 and Ser. No. 60/270,687, filed Feb. 22, 2001.

FIELD OF THE INVENTION

The invention pertains to ultrasonic inserts of a type used in medical/dental treatments. More particularly, the invention pertains to such inserts with enhanced operating efficiency and user comfort.

BACKGROUND OF THE INVENTION

Ultrasonic scalers are used in dental offices for de-plaqueing teeth. Unlike manual scalers, these instruments are powered i.e., the tip of the instrument vibrates at an ultrasonic frequency allowing quick and easy debridement. The operator has less hand fatigue as most of the energy for removing the plaque comes from the generator that powers the instrument. The dental practitioner need only lightly touch the tip of the instrument at an angle to the tooth surface to dislodge the plaque.

Known ultrasonic scalers, such as scaler **10** illustrated in FIG. 1A, have a handpiece **12***a* coupled at one end **12***a*-**1** to a cable **12***b* which includes a hose, to provide a fluid, and conductors to provide electrical energy. The other end of the cable **12***b* terminates at an electrical generator and fluid source **12***c*. One type of fluid is water.

The other end of the handpiece **12***a*-**2** is hollow and is intended to receive a replaceable insert **14** with a transducer **14***a* (magnetostrictive or piezoelectric) carried on the insert. The transducer **14***a* extends from a proximal end of the insert **14** into the hollow body **12***a*-**2**. An ultrasonically vibrated tip **14***b* extends from a distal end of the insert. One such insert has been disclosed and claimed in U.S. Pat. No. 5,775,901, entitled "Insert For Ultrasonic Scaler", incorporated herein by reference.

Known magnetostrictive ultrasonic inserts function by exciting a stack of thin nickel plates at a frequency equal to the stack's natural frequency. The excitation is induced through an electrical generator in unit **12***c*, which supplies a current to a coil embedded in the handpiece. When the insert **14** is placed in the handpiece **12***a* and the frequency generator **12***c* is powered on, the operator tunes the generator (manual tuning) until it reaches the resonance frequency i.e., attains the natural frequency of the insert. Alternately, autotune units automatically lock on the insert resonance frequency once powered on. At this time, the stack starts vibrating. This vibration of the stack is amplified and transmitted to the tip **12***b* by means of a connecting body or concentrator. The connecting body is made from material that provides good sound transmission efficiency.

While the insert **14** is operational, fluid is pumped through the cable-generator system **12***b, c* and through the handpiece **12***a* to the tip **14***b* of the insert **14**. The vibrating tip **14***b* breaks the fluid stream into a spray. The spray not only keeps the tip cool, but also keeps the surface of the tooth cool and provides protection against tissue damage.

The fluid path through the handpiece **12***a* needs to be sealed such that no leakage occurs until the fluid stream exits

from the insert at the very tip through a fluid delivery channel. Typically, ultrasonic inserts do not have any moving parts other than the minuscule displacement of the nickel stack, the connecting body or the tip.

Known magnetostrictive dental scaling ultrasonic inserts used in the U.S.A. are designed to vibrate at 25 kHz or 30 kHz frequencies. Another system, popular in Europe, uses a piezoelectric transducer.

In using an ultrasonic scaler during a cleaning, the dental practitioner will need to repeatedly re-orient the location of the insert tip **14***b* with respect to tooth surface depending on which tooth of the mouth is being cleaned. In making this angular adjustment, as illustrated in FIG. **1**B, the practitioner will typically take the insert out of the patient's mouth, rotate the insert **14**, and tip **14***b*, inside the handpiece **12***a* locating tip **14***b* at a desired angular position. Both hands are used for this rotation as the frictional forces that produce a tight fit of the insert **14** in handpiece **12***a* must be overcome. During a typical treatment, the process of reorienting the tip must be carried out numerous times. This is not only time consuming but also interrupts the ease and smooth flow of work.

In areas of the mouth where the practitioner chooses not to rotate the insert **14**, the practitioner's wrist must be twisted sufficiently to achieve the same function. This twisting action is opposed by the resistance of the cable **12***b*, the fluid supply hose and power conductors, which is attached to the handpiece **12***a*.

There continues to be a need for ultrasonic scalers which are more comfortable and less fatiguing to use than known instruments. Preferably, any improvements will be downwardly compatible with the numerous generators and handpieces that are already present in dental offices.

SUMMARY OF THE INVENTION

A rotatable ultrasonic insert has a body section which carries a bearing for rotatably engaging an ultrasonic handpiece. The body is rotatable, about an axial centerline.

Rotation can be effected by applying a force only to the insert. In response, the insert rotates but the handpiece does not. Hence, single handed, two finger rotation is possible.

Preferably, a swivel feature is located at the gripping region of the insert, i.e., close to the treatment tip, where the practitioner would typically position his or her fingers. The swivel allows the insert to rotate 360 degrees without any limitation. This enables the practitioner to position the insert, and the tip, at any angular orientation without having to take the insert out of the patient's mouth. The swivel also allows rotation of the gripping region and tip without having to rotate the handpiece and/or the supply cord. This removes the resistance from the operator's hand and reduces hand fatigue.

Additionally, a large diameter grip or handle, not only reduces finger fatigue but also transmits a larger torque to the swivel feature for the same amount of force.

An elastomeric handle, carried by the body, comfortably interfaces with a user's fingers. The user can rotate the elastomeric handle and the insert with two fingers relative to the handpiece. Hence, during treatment there will be no need to rotate the handpiece.

The elastomeric material allows for a positive grip since it deforms under finger pressure and becomes locally non-cylindrical in shape. The preferred material is silicone. Silicone is not only repeatedly sterilizable under most sterilization processes found in dental offices but also provides

good traction with respect to the type of gloves which are commonly used in dental offices.

The elastomeric handle engages the body only at a region of minimal ultrasonically induced, vibration. The limited connectivity between the body and the elastomeric handle minimizes build up of heat between the body and that handle. It also avoids damping ultrasonic vibrations transmitted along the body.

A method of assembly includes:

providing a body which carries an ultrasonic transducer, at one end, and, a displaced treatment applying tip at the other end;

sliding a rotary handle past the treatment applying tip toward the bearing;

connecting the handle to the body at a region of minimal ultrasonic vibration.

In another aspect of the invention, an adaptor has an external periphery which can be slidably and releasibly inserted into the opening in the handpiece. A standard ultrasonic insert is inserted through the adaptor into the handpiece. The insert can then be rotated relative to the handpiece with a rotational force applied only thereto. Alternatively, the adaptor can be snap fitted onto an exterior periphery of a handpiece.

Numerous other advantages and features of the present invention will become readily apparent from the following detailed description of the invention and the embodiments thereof, from the claims and from the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1**A illustrates a prior art ultrasonic scaler having an insert and handpiece;

FIG. **1**B illustrates one aspect of usage of the prior art insert/handpiece combination of FIG. **1**A;

FIG. **2**A illustrates an insert in accordance with the present invention;

FIG. **2**B illustrates the insert of FIG. **2**A in a handpiece as in FIG. **1**A and aspects of usage thereof;

FIGS. **3**A, B and C are various views of an ultrasonic insert body in accordance with the present invention;

FIGS. **4**A, B, C and D are various views of a snap-fit rotary bearing usable with the body of FIG. **3**A;

FIGS. **5**A, B, C and D are various views of a torque lock in accordance with the present invention;

FIGS. **6**A, B and C are various views of a swivel housing in accordance with the present invention;

FIGS. **7**A, B are various views of a cone usable in an insert in accordance with the present invention;

FIGS. **8**A, B and C illustrate steps in assembling an insert in accordance with the present invention;

FIG. **9**A is a side sectional view of an insert in accordance with the invention illustrating the relationship of various elements assembled in the steps of FIGS. **8**A, B and C;

FIG. **9**B is an enlarged sectional view illustrating aspects of a section of FIG. **9**A;

FIG. **10**A is a side sectional view of a handpiece carrying a snap-on adaptor in accordance with the present invention;

FIG. **10**B is an enlarged partial side view of the handpiece and adaptor of FIG. **10**A with a conventional ultrasonic insert positioned therein;

FIG. **10**C is an over-all view of an insert as in FIG. **1** combined with an adaptor as in FIG. **10**A;

FIG. **11**A is an enlarged side view of an alternate embodiment of an insert in accordance with the present invention;

FIG. **11**B is an enlarged partial side sectional view of the insert of FIG. **11**A inserted into a handpiece of an ultrasonic scaling unit, generally of a type illustrated in FIG. **1**;

FIG. **11**C is a side view of a portion of the handpiece of FIG. **11**B;

FIG. **11**D is a side view of a collar threadable onto the handpiece of FIG. **11**B;

FIGS. **12**A, B are top and side views of a preferred form of an ultrasonic transducer; and

FIG. **12**C is an end view of the transducer of FIG. **12**B.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

While this invention is susceptible of embodiment in many different forms, there are shown in the drawing and will be described herein in detail specific embodiments thereof with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the specific embodiments illustrated.

FIG. **2**A illustrates an insert **20** in accordance with the present invention. The insert **20** includes a transducer **20***a* which is illustrated as a magnetostrictive transducer. Alternately, it could be a piezoelectric ultrasonic transducer without departing from the spirit and scope of the present invention.

The transducer is rigidly coupled to an elongated body **20***b* which is covered in part by a cylindrical, elongated deformable elastomeric grip **20***c*. The grip **20***c* terminates in a cone **20***d* which is positioned between the grip **20***c* and operative treatment applying tip **20***e*.

The insert **20** operates in accordance with the principals of known ultrasonic dental instruments as discussed above relative to FIG. **1**A. However, insert **20** also carries a rotary bearing **24** which exhibits a hollow cylindrical stem section **24***a* which defines a cylindrical region **24***b* which receives a sealing O-ring **24***c*. The hollow member **24***a* terminates at a disc **24***d* of larger diameter. A planar surface **24***d*-**1** of disk **24** is adjacent to stem **24***a*

As discussed subsequently, when installed on the elongated body **20***b*, the rotary bearing member **24** is rotatable relative to the body **20***b*, gripping member **20***c* and tip **20***e*. Hence, if the member **24** is fixed, the body **20***b*, gripping member **20***c* and tip **20***e* are readily rotatable therein.

FIG. **2**B illustrates the standard ultrasonic handpiece **12***a*, cable **12***b* and generator **12***c*, discussed above, of a type found in dental offices. The insert **20** is slidably receivable, in a direction **16***a*, in the hollow end **12***a*-**2** of the handpiece **12***a*.

The cylindrical stem **24***a* of the rotary bearing **24** slides into the hollow handpiece **12***a*. The O-ring **24***c* slidably engages the interior periphery of the handpiece **12***a* providing a fluid seal and reliably engaging the insert **20** with the handpiece **12***a*.

When installed in the handpiece **12***a*, as illustrated in FIG. **2**B, insert **20** can be rotated relative to handpiece **12***a* with rotary forces applied to the deformable gripping member **20***c* for purposes of orienting the tip **20***e* relative to a tooth being de-plaqued. As illustrated in FIG. **2**B, the practitioner need not restrain the handpiece **12***a* while rotating the insert **20**. Additionally, insert **20** is relatively rotatable relative to handpiece **12***a* using only two of the practitioner's fingers. Thus, the orientation of the tip **20***e* can be continuously altered with only two of the practitioner's fingers, requiring only one hand, while the scaling operation proceeds. This will reduce operator fatigue and substantially shorten the

time necessary for the scaling process. The expected torque needed to rotate insert **20** preferably will be less than 2.0 inch-oz.

When the practitioner has concluded the de-plaqueing process, the insert **20** can be removed from the handpiece by pulling it axially from the handpiece in a direction **16***b* and sterilized. The same insert or a different insert can then be subsequently inserted into handpiece **12***a* to treat the next patient. It will be understood that the present invention is applicable to ultrasonic inserts which utilize either magnetostrictive or piezoelectric transducers without limitation.

FIGS. **3**A, **3**B, **3**C illustrate different views of the body **20***b* of the insert **20**. As illustrated in FIGS. **3**A and **3**B, body portion **20***b* is attached to a first end **20***a*-**1** of transducer **20***a* as would be understood by those of skill in the art. An elongated cylindrical extension **20***b*-**1** extends axially from transducer **20***a* toward tip **20***e*.

The elongated cylindrical metal member **20***b*-**1**, as would be known to those of skill in the art, is caused to vibrate axially, in response to electro-magnetic signals received at transducer **20***a* from handpiece **12***a*. The signals are produced by generator **12***c*. This axial ultrasonic vibration is in turn coupled to the tip **20***e* and used for effecting de-plaqueing of the subject tooth T, in a spray of fluid M, illustrated in phantom in FIG. **3**C.

A pair of notches **20***b*-**2**, **20***b*-**3** is formed on elongated body member **20***b*-**1** in a region of substantially zero axial ultrasonic vibration. While a pair of notches **20***b*-**2**, -**3** has been illustrated in FIG. **3**B, it will be understood that a single notch, or three notches could be used without departing from the spirit and scope of the present invention. Additionally, the exact shape of the generally rectangular notches **20***b*-**2**, -**3** is not a limitation of the present invention.

An interior or base plane **20***b*-**2**', **20***b*-**3**' of each notch **20***b*-**2**, -**3** is parallel to a plane through the central axis of tip **20***e*. This notch/tip configuration facilitates energy transmission along insert **20** without increasing the risk of a mechanical fracture due to potential fatigue stress.

An elongated fluid flow slot **20***b*-**4** extends axially in the region where the body **20***b*-**1** interfaces with the tip **20***e*. As discussed subsequently, fluid for the spray M flows therethrough.

FIGS. **4**A, B, C and D illustrate different views and additional details of rotary bearing **24**. As illustrated therein, the cylindrical stem **24***a* is hollow and defines an interior peripheral surface **24***e* which is adjacent to the elongated body portion **20***b*, see FIG. **2**A. The bearing member **24** carries a second O-ring **24***c*-**1** in a cylindrical region **24***d*-**2** which is adjacent to a plurality of radially disposed spring-loaded fingers indicated generally at **24***g*.

The fingers **24***g* each terminate at a barbed free end, such as **24***g*-**1**, -**2**, -**3** with preferably four such fingers disposed radially about the annular surface **24***d*-**2**. Neither the number nor the exact shape of the ends **24***g*-**1**, -**2** . . . -n are limitations of the present invention. As discussed in more detail subsequently, the fingers **24***g*-**1**, -**2**, -**3**, -**4** are deflectable radially inward during assembly and are biased radially outwardly to return to their undeflected condition, illustrated in FIG. **4**A, **4**B.

The second O-ring **24***c*-**1** which is positioned adjacent annular surface **24***d*-**2** cooperates with O-ring **24***c* to provide a sealed fluid flow path between handpiece **12***a* and cone **20***d*. Cooling fluid flows from handpiece **12***a* through aperture **24**-**1**, FIG. **4***c*, and past the fingers **24***g*-**1**, -**2**, -**3**, -**4**. It will be understood that the number of fingers **24***g* is not a limitation of the present invention.

FIGS. **5**A–**5**D illustrate various views of a torque lock **30** which couples a torque due to force applied to deformable gripping member **20***c* by the user's fingers to the body **20***b* and treatment tip **20***e*. The torque lock **30** is preferably molded of a sterilizable thermoplastic which, as discussed below, permits it to deform during assembly without fracturing.

The torque lock **30** has a hollow body section **32***a* with an exterior periphery **32***b* and an internal circumferential periphery **32***c*. The torque lock is molded with a slot **34***a* formed in the body **32***a* which permits outward radial deformation of sections **34***b* and **34***c*, adjacent the slot **34***a*, as the torque lock **30** is slid onto the elongated body portion **20***b*-**1**. Surfaces **36***a*, **36***b* slidably engage the notches **20***b*-**2**, -**3** of the elongated member **20***b*-**1**. When the notches are so-engaged, the deformable members **34***b, c* move radially inwardly to a non-deformed condition. In this state, torque lock **30** is locked to the body **20***b* at the notches **20***b*-**2**, -**3**.

The interaction between the surfaces **36***a, b*, in the slots **20***b*-**2**, -**3** inhibits both rotation and translation of the torque lock **30** relative to the body member **20***b*-**1**. Hence, rotating the torque lock **30** will also rotate the body **20***b* of the insert.

Once the torque lock **30** has been installed on the body member **20***b*-**1** at the slots **20***b*-**2**, -**3**, it will be fixedly located at a region of substantially zero axial ultrasonic vibration. This minimizes a build-up of heat between the vibrating body **20***b*-**1** and the torque lock **30**. As will be understood by those of skill in the art, in addition to locating the notches **20***b*-**2**, -**3** at a region of minimal axial ultrasonic vibration, preferably centered on the expected nodal point of zero vibration, the cross section of the connecting body portion **20***b*-**1** through the notches **20***b*-**2**, -**3** will have a large enough cross-sectional area to transmit ultrasonic vibrations without constriction.

FIGS. **6**A, B, C illustrate various views of a housing **40** which is press fit over torque lock **30** and which slidably and lockingly engages barbed fingers **24***g*-**1**, -**2**, -**3**, and -**4** of the rotary bearing **24**. The housing **40** has an elongated generally cylindrical body **42***a* with a smooth exterior periphery **42***b*. The body **42***a* terminates at an end **42***c* adjacent an annular shoulder **42***d*.

The shoulder **42***d* in turn has an end surface **42***d*-**1**. When installed, the end surface **42***d*-**1** is adjacent to and rotates relative to annular surface **24***d*-**3** of bearing **24**.

The annular member **42***d* exhibits an internal cylindrical peripheral surface **42***d*-**2** which traps O-ring **24***c*-**1** in position, forming a fluid seal with bearing **24** when surface **42***d*-**1** is positioned adjacent to surface **24***d*-**3**. When so-positioned, the housing **40** can rotate relative to bearing **24** but is not movable axially relative thereto.

When the housing **40** is rotated relative to the bearing **24**, the surface **42***d*-**2** slides over O-ring **24***c*-**1** without excessive friction thereby enabling a practitioner to rotate the tip **20***e* relative to the handpiece **12***a* with the use of force applied to elastomeric gripping member **20***c* by only two fingers.

The housing **40** has an interior, cylindrical peripheral surface **42***b*-**1** which surface deflects the barbed fingers **24***g*-**1**, -**2**, -**3**, -**4** radially inwardly when the housing **40** is slid onto the fingers **24***g*. The fingers **24***g*, which have been inwardly radially deflected by the surface **42***b*-**1** engage a cylindrical slot **42***b*-**2** with a snap fit. The radially compressed fingers **24***g* expand outwardly radially and the barbed ends **24***g*-**1**, -**2**, -**3**, -**4** lock into the slot **42***b*-**2** precluding axial motion of the housing **40** away from surface **24***d*-**3** of bearing **24**.

As the housing **40** is slidably engaging the barbed fingers **24***g*-**1**, -**2**, -**3**, -**4** and internal cylindrical peripheral surface

42*b*-3 engages exterior cylindrical peripheral surface 32*b* of torque lock 30 with a press or interference fit. The press fit between torque lock 30 and housing 40 locks those two parts together precluding either axial linear movement or rotary movement therebetween. The end 42*b* of housing 40 carries a plurality of threads 42*b*-4.

The snap fit between the housing 40 and the rotary bearing 24, in combination with the O-ring 24*c*-1 provide a sealed fluid flow path from inflow periphery 24*e* of bearing 24 through outflow end surface 42*b*-5 of housing 40. This fluid flow seal, as noted above, precludes fluid leakage. The exterior cylindrical surface 24*g*' of each of the fingers 24*g* rotatably engages the internal cylindrical surface 42*b*-1 of the housing 40. This provides a pair of rotatable bearing surfaces which permit smooth two finger rotation of the deformable member 20*c* and the treatment tip 20*e*. A medically acceptable, sterilizable, lubricant is preferably provided between the bearing surfaces to improve rotational smoothness and further reduce friction and required torque.

FIGS. 7A and 7B are views of cone 20*d* which is carried by rotatable housing 40. Cone 20*d* has an internal flow path 50*a* which is sealed by O-ring 50*b*. Cone 20*d* includes a set of threads 52. Cone 20*d* is coupled to housing 40 by the rotatable engagement of threads 42*b*-4 of housing 40 and 52 of cone 20*d*.

The O-ring 50*b* precludes leakage between an end 50*c* and a region of body portion 20*b*-1 which extends therethrough. Fluid exits cone 20*d* via fluid flow channel 20*b*-4 in the body portion 20*b*-1. Fluid exits the cone 20*d* in the channel 20*b*-4 as a stream. The stream of fluid impacts the vibrating tip 20*e* and creates a smooth spray pattern M suited for cooling and cleaning tissues. Adhesives, such as epoxy, can be used to permanently attach the cone 20*d* to the housing 40.

FIGS. 8A, 8B and 8C illustrate the steps of assembly of the insert 20. Groove 20*b*'-1 in body section 20*b*' provides a positive gripping surface usable during assembly by manufacturing fixtures to block axial movement of the insert 20.

As illustrated in FIG. 8A, initial steps of assembly of the insert 20 include sliding rotary bearing member 24 past operative tip 20*e* onto body portion 20*b*-1. The torque lock 30 is then slid onto the operative element 20*e* and forced along the elongated body 20*b*-1, which in turn forces elements 34*b, c* radially outward until surfaces 36*a, b* thereof slidably engage the slots 20*b*-2, -3. This slidable engagement with the slots in the body member 20*b* locks the torque lock 30 to the body member 20*b* and traps the bearing member 24 against a portion 20*b*' of the body 20*b* precluding axial movement thereof. The bearing member 24 continues to be rotatable relative to the elongated body portion 20*b*.

As illustrated in FIG. 8B, the housing 40 is then slid onto and past the operative element 20*e* and forced onto the rotary bearing 24, thereby radially inwardly deflecting the barbed fingers 24*g*-1, -2, -3, -4 and also press fit onto external peripheral surface 32*b* of torque lock 30 adjacent to disc 24*d*. When seated on the bearing member 24, the inwardly deflected fingers 24*g* expand into radial slot 42*b*-2, axially locking the housing 40 to the bearing 24 while still permitting relative rotary motion therebetween.

The circular elastomeric gripping member 20*c* can be slid onto housing 40 either before or after the cone 20*d* is threadably engaged therewith. The gripping region 20*c* has an inner diameter which is slightly smaller than the outer diameter of the housing 40. The member 20*c* thus elastically attempts to contract around the housing 40 which minimizes unintended slippage of the grip 20*c* relative to the housing 40. Member 20*c* can also be permanently attached to housing 40 with adhesive.

FIG. 9A illustrates a side sectional view of an assembled insert 20 in accordance with the method of steps of FIGS. 8A, B and C. FIG. 9B is an enlarged side sectional view of a portion of FIG. 9A further illustrating the relationships of the various elements therein.

As will be understood by those of skill in the art, preferably tip 20*c* will be formed and heat treated prior to the start of the assembly process illustrated in FIG. 8A. By forming housing 40 as a separate element from core 20*d*, the length of each is less than the combined length of 20*d* and 40. Hence, each can be independently slid over exemplary curved tip 20*e* though the assembled combination 20*d* and 40 will not slide over tip 20*e*.

FIG. 10A illustrates a snap-on plastic adaptor 70 which is intended to be used with a standard handpiece, such as the handpiece 12*a*. As illustrated in FIG. 10A, handpiece 12*a* includes an annular depression 12*c* adjacent to open end 12*a*-2. The adaptor 70 snap-fits onto the handpiece 12*a* at the groove 12*c*.

Adaptor 70 has a body section 72*a* which carries an annular locking protrusion 72*b* which slidably engages the slot 12*c* locking the adaptor 70 thereto. The adaptor 70 also includes a bearing 74*a* which is carried in an interior region 74*b* of the body 72*a*. An O-ring seal 74*c* can be positioned adjacent to the bearing 74*a* to minimize the likelihood of leakage from fluid flowing through the handpiece 12*a* into an insert coupled thereto.

The insert 70 defines a channel 76*a* which co-extends with and abuts channel 12*d* in handpiece 12*a*. The channels 76*a* and 12*d* receive a standard insert such as the insert 14, which is to be rotatably coupled to handpiece 12*a* and to be energized thereby.

FIG. 10B illustrates added details of standard insert 14 coupled to adaptor 70 for rotation relative to handpiece 12*a*. In the embodiment illustrated in FIG. 10B, the adaptor 70 in combination with handpiece 12*a* and insert 14 provide a sealed fluid flow path between the interior peripheral surface 12*b* of the handpiece and tip 14*b* of the insert. In this configuration, a user can rotate insert 14 relative to handpiece 12*a* by applying rotary forces to the grip 14*c* in a manner analogous to the way in which rotary forces are applied to the grip 20*c* of rotatable insert 20 previously described.

Using insert 70, a standard handpiece, in combination with standard inserts, such as the insert 14, can cost effectively provide improved convenience and comfort for the practitioner. It will be understood, if desired, that the insert 70 could be color coded. The insert 70 can be molded of any sterilizable plastic such a thermoplastic material commercially available and known as polyphenylsulfone. It will also be understood that a plurality of snap-fit fingers, such as the fingers 72*b*, can be molded in housing 72*a* for purposes of releasibly attaching the adaptor to the handpiece 12*a*.

FIG. 10C is an over-all view of insert 14 coupled to handpiece 12*a* via adaptor 70.

FIGS. 11A and 11B illustrate an alternate form of an adaptor 80 usable with a handpiece 82. The adaptor 80 includes a cylindrical body section 80*a* which carries a bearing 80*b* which could be implemented as a plastic ring bearing. The bearing 80*b* is carried in a cylindrical slot 80*c* in housing 80*a*.

Housing 80*a* also carries an O-ring seal 80*d* in a second slot 80*e*. Finally, the body 80*a* terminates at a plurality of

deflectable locking fingers **80***f*. The body **80***a* is hollow and defines an internal peripheral cylindrical surface **80***g*.

Insert **80** is slidably receivable into handpiece **82** with a snap-fit. The exterior surfaces of the fingers **80***f* slidably engage a locking slot **82***a* formed in an interior peripheral surface **82***b* of the handpiece **82**. The interior peripheral surface **82***b* also includes a slot **82***c* for receipt of the O-ring seal **80***e*, and, a slot **82***d* which receives the rotary bearing **80***b* carried by the insert **80**. It will be understood that the O-ring **80***d* provides a fluid seal between handpiece **82** and an insert, such as the insert **14** shown in part in phantom, which has been slidably inserted into the adaptor **80** in contact with the internal peripheral cylindrical surface **80***g*. When so-inserted, the insert **14** can be rotated, along with adaptor **80** relative to the handpiece **82** so as to promote the convenience and comfort of a practitioner. A collar **86** is threadable onto the end of the handpiece **82** to trap the adaptor **80** in place and prevent axial movement thereof.

FIGS. **12**A–C illustrate details of a preferred structure of stack **20***a*. By impressing a "W" bend **20***a*-**1** along the length of each member of the stack, as illustrated, stiffness of the stack can be increased. This in turn promotes continued alignment of the stack relative to central axis HP-A, see FIG. **2**B, while the insert **20** is being rotated. The improved alignment minimizes the likelihood of the stack **20***a* rubbing against internal peripheral surface **12***d* during rotation, hence eliminating a possible source of friction and noise.

From the foregoing, it will be observed that numerous variations and modifications may be effected without departing from the spirit and scope of the invention. It is to be understood that no limitation with respect to the specific apparatus illustrated herein is intended or should be inferred. It is, of course, intended to cover by the appended claims all such modifications as fall within the scope of the claims.

What is claimed:

1. An ultrasonic dental instrument grippable by an operator comprising:

a handpiece; and

an ultrasonic insert having two parts, a treatment applying tip is fixedly attached to one part, the one part carrying an ultrasonic transducer, a second part of the insert is rotatable relative to the one part, wherein the insert is removably carried by the handpiece, and, wherein the tip, the one part and the transducer are rotatable together relative to the second part and the handpiece by a force applied only to the one part of the insert.

2. An instrument as in claim **1** wherein the insert is releasibly coupled for axial insertion into and removal from the handpiece.

3. An instrument as in claim **1** wherein the insert carries a user gripping member for rotating the tip.

4. An instrument as in claim **1** wherein the tip is rotatable through an arc on the order of at least two hundred seventy degrees.

5. An instrument as in claim **1** which includes an elastomeric handle wherein the elastomeric handle comprises silicone.

6. An ultrasonic dental instrument grippable by an operator comprising:

a handpiece; and

a two part ultrasonic insert with a treatment applying tip fixedly attached to one part, a second part of the insert is rotatable relative to the first part, wherein the insert is removably carried by the handpiece, and, wherein the tip and the one part are rotatable relative to the second part and the handpiece by a force applied only to the one part of the insert, wherein the insert is releasibly coupled for axial insertion into and removal from the handpiece and wherein the insert carries a user comfortable, deformable, elastomeric member whereby the user can rotate the tip relative to the handpiece.

7. An instrument as in claim **6** wherein the tip is rotatable through an arc on the order of at least two hundred seventy degrees.

8. An instrument as in claim **6** wherein the elastomeric member comprises silicone.

9. An ultrasonic dental instrument grippable by an operator comprising:

a handpiece; and

an ultrasonic insert with a treatment applying tip wherein the insert is carried by the handpiece, and, wherein the tip is rotatable relative to the handpiece by a force applied only to a portion of the insert, the insert is releasibly coupled for axial insertion into and removal from the handpiece, the insert carries a user comfortable, deformable elastomeric member whereby the user can rotate the tip relative to the handpiece; and wherein the insert includes an elongated body with an end coupled to the tip and a torque transferring cylinder coupled between a portion of body and the elastomeric member whereby the cylinder is mechanically locked to the body such that a rotary force applied to the elastomeric member establishes a torque for rotating the body.

10. An instrument as in claim **9** wherein the cylinder is coupled to the body at a region of minimal axial ultrasonic vibration.

11. An instrument as in claim **9** which includes a cylindrical bearing which is slidably locked to the handpiece in which the torque transferring cylinder rotates.

12. An ultrasonic dental instrument grippable by an operator comprising:

a handpiece; and

an ultrasonic insert with a treatment applying tip wherein the insert is carried by the handpiece, and, wherein the tip is rotatable relative to the handpiece by a force applied only to a portion of the insert, wherein the insert is releasibly coupled for axial insertion into and removal from the handpiece, wherein the insert carries a user comfortable, deformable elastomeric member whereby the user can rotate the tip relative to the handpiece; and which includes a rotary bearing positioned adjacent to the elastomeric member whereby the tip and the elastomeric member are rotatably decoupled from and are rotatable together relative to the handpiece.

13. An instrument as in claim **12** wherein the bearing is located at least in part, adjacent to a region of minimal axial ultrasonic vibration.

14. An ultrasonic dental instrument grippable by an operator comprising:

a handpiece; and

an ultrasonic insert having two parts, a treatment applying tip is fixedly to one part, the one part carrying an ultrasonic transducer, a second part of the insert is rotatable relative to the one part, wherein the insert is removably carried by the handpiece, and, wherein the tip, the one part and the transducer are rotatable together relative to the second part and the handpiece by a force applied only to the one part of the insert wherein the one part of the insert includes an elongated body with an end coupled to the tip and a torque transferring cylinder coupled between a portion of the body and a cylindrical housing whereby the cylinder is

mechanically locked to the body such that a rotary force applied to the cylindrical housing establishes a torque for rotating the body.

15. An instrument as in claim **14** wherein the cylinder is coupled to the body at a region of minimal axial ultrasonic vibration.

16. An instrument as in claim **14** which includes an external annular positioning flange on the body which flange abuts an end of the handpiece when the body is inserted therein.

17. An ultrasonic dental instrument grippable by an operator comprising:

a handpiece; and

an ultrasonic insert with a treatment applying tip wherein the insert is carried by the handpiece, and, wherein the tip is rotatable relative to the handpiece by a force applied only to a portion of the insert, the insert includes an elongated body with an end coupled to the tip and a torque transferring cylinder coupled between a portion of the body and a cylindrical housing whereby the cylinder is mechanically locked to the body such that a rotary force applied to the cylindrical housing establishes a torque for rotating the body, and, which includes a cylindrical bearing which is slidably locked to the handpiece in which the torque transferring cylinder rotates.

18. An ultrasonic dental instrument grippable by an operator comprising:

a handpiece; and

an ultrasonic insert with a treatment applying tip wherein the insert is carried by the handpiece, and, wherein the tip is rotatable relative to the handpiece by a force applied only to a portion of the insert, and, which includes a rotary bearing positioned adjacent to an elastomeric member whereby the tip and the elastomeric member are rotatable together relative to the handpiece.

19. An instrument as in claim **18** wherein the bearing has an end located adjacent to a region of minimal axial ultrasonic vibration of the insert.

20. An ultrasonic dental instrument grippable by an operator comprising:

a handpiece; and

an ultrasonic insert with a treatment applying tip wherein the insert is carried by the handpiece, and, wherein the tip is rotatable relative to the handpiece by a force applied only to a portion of the insert, and, which includes:

a hollow, generally cylindrical bearing member rotatably latched to the insert wherein the cylindrical bearing member slidably engages the handpiece.

21. An instrument as in claim **20** which includes a deformable gripping handle locked to the insert.

22. An instrument as in claim **21** wherein the gripping handle is carried by an element which slidably engages a region of the insert exhibiting minimal vibration.

23. An instrument as in claim **22** wherein the element has first and second sections wherein one section lockingly engages a slot in the minimal vibration region of the body.

24. An instrument as in claim **23** wherein the second section engages the first section with an interference fit.

25. An instrument as in claim **24** wherein the second section has a cylindrical external periphery and carries the deformable gripping handle thereon.

26. An instrument as in claim **24** which includes a conical section which couples to the second section at an end thereof extending toward the tip.

27. An instrument as in claim **20** wherein the insert defines a slot thereon and wherein the cylindrical bearing member is located adjacent to the slot.

28. An instrument as in claim **27** which carries a cylindrical user handle, deformable at least in part, wherein an end of the handle is adjacent to an end of the cylindrical bearing member.

29. An instrument as in claim **27** wherein the slot is located on the insert at a region of minimal axial ultrasonic vibration.

30. An instrument as in claim **29** which carries a cylindrical user handle wherein a portion of the handle lockingly engages the slot and wherein the bearing member is thereby blocked from axial movement relative to the insert.

31. An instrument as in claim **30** wherein a portion of the handpiece slidably engages the bearing member.

32. An ultrasonic dental instrument grippable by an operator comprising:

an ultrasonic insert with a treatment applying tip, a grip, an elongated body, and a transducer, wherein the grip is engaged with the body at a point of minimal vibration and a rotatable sleeve is carried on the body adjacent to the grip.

33. An instrument as in claim **32** wherein the insert is carried by an energizing handpiece.

34. An instrument as in claim **32** wherein the tip is rotatable relative to the handpiece by a force applied to only a portion of the insert.

* * * * *

EXHIBIT C

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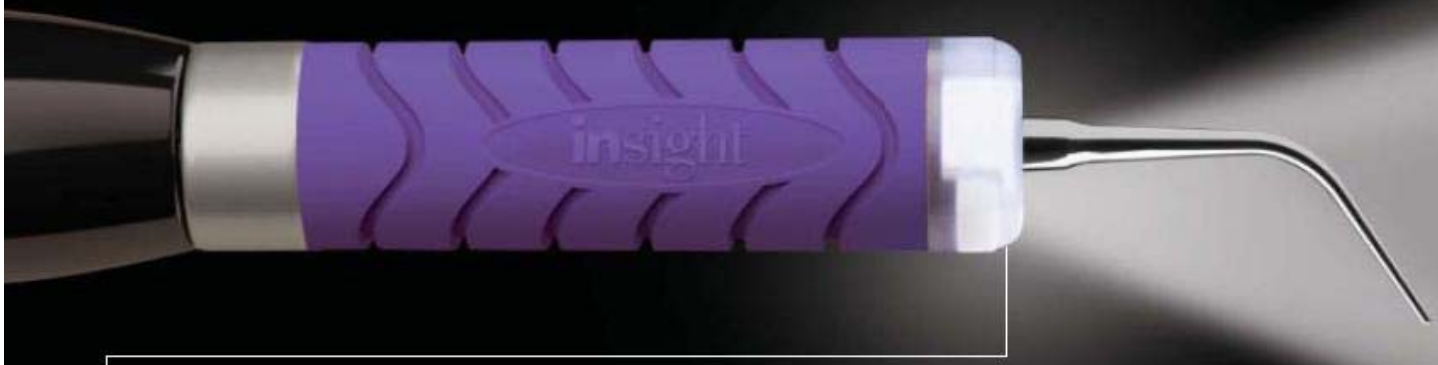

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EXHIBIT D


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